VEER NARMADA SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

Chemistry

Paper – VI (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: Quantum Mechanics 5 Hrs

Postulates of Quantum mechanics, particles in three dimensional box; particle in a ring and in a cylinder; Schrodinger's wave equation in polar coordinates, its separation in to R(H) and ϕ

Topic –2:Molecular symmetry 6 Hrs

Axis of symmetry, centre of symmetry, improper axis of symmetry, plane of symmetry and identity, classification of molecules in to point groups , construction of multiplication table of C_{2v}, C_{3v}, C_{2h}.

UNIT – II

Topic –1:Hybridisation 3 Hrs

Bond angles in sp , Sp^2 and Sp^3 hybrid orbitals using wave functions (fully mathematical calculation)

Topic –2:Chemical bonding 4 Hrs

Existence and stability of H_2^+ ion based on MOT. Full mathematical deviation of E_s, E_A , Ψ^2S & Ψ^2A Bonding in tetra Borane (10), penta borane (9) and dodeca borane (12) anion.

Topic –3:Metal complexes 5 Hrs

Reaction mechanism of ligand substitution in octahedral complexes (i)SN_1 (ii) SN_2 (iii) Solvent interventation (iv) ion pair formation (v) conjugate base formation (SN1 CB).

-Solvolysis (Hydrolysis reaction)- Acid hydrolysis & Base hydrolysis

-Redox (Single Electron Transfer)Reactions

UNIT – III

Topic –1:Thermodynamic and KineticAspects of metal complexes 5 Hrs

A brief out line of thermodynamic stability of metal complexes and factors, affecting a stability, substitution reaction in square planar complexes.

Topic –2: Metal carbonyls 6 Hrs

Definition, classification, nature of bonding in metal carbonyls, structure and IR spectra in $Ni(CO)_4$; $Fe(CO)_5$, $Fe_2(CO)_9$, $Mn_2(CO)_{10}$, $Ni(CO)_4$

UNIT – IV

Topic –1:Hydrogen bonding 3 Hrs

Theory of hydrogen bonding, classification importance of hydrogen bonding in ice, Effect of hydrogen bonding in various fields.

Topic –2:Metal-Ligand Bonding in Transition Metal Complexes 10 Hrs

Limitations of valance bond theory, Elementary idea of Crystal – field theory, crystal field splitting in Octahedral, Tetrahedral and Square planar complexes; factors affecting the Crystalfield parameter.

UNIT – V

Topic –1:Organo-metallic compounds 4 Hrs

Definition classification, nature of bonding in Organo-metallic compounds, structure and bonding in maganacene, beryllocene dibenzene chromium, Zeise ion and gaseous dimethyl beryllium.

Topic –2:Hard and soft acid bases(HSAB) 4 Hrs

Modern concept of acid base, Classification in to Hard and soft acid bases, strength of acid-base, their hardness and softness, Characteristic of hard soft acid base and their electronegativities.

Topic –3:Environmental pollution: 5 Hrs

Introduction types of pollutions (i) Gaseous Pollution in air , acidrains and green house effect (ii) Water pollution: types of water pollutants, trace elements in water and their effects; Determination of BOD and COD (iii) Radiation pollution – Cause, effects, Controls (iv) Noise pollution and their effect and controls (v) Oil pollution and their controls

Reference Books:

(1) Introduction to quantum chemistry, by A. K. Chandra
(2) Qunatum mechanics in chemistry by M. H. Hanna
(3) Theoritical Inorganic chemistry by Day & Selbin
(4) Advanced Inorganic Chemistry by Cotton and Wilkinson
(5) Uni. Chemistry by B. H. Mohan
(6) Structural Inorganic chemistry by A. F. Wells.
(7) Chemical Bonding by an introduction Rawal, Patel & Patel

(8) Basic Inorganic Chemistry by Cotton and Wilkinson
(9) A Text Book of Inorganic Chemistry by P. L. Soni
(10) Introduction to Inorganic chemistry by Durrant & Durrant ,
(11) Modern coordination chemistry R. Lewis & R. G. Wilkinson.
(12) Inorganic chemistry – principles of structure and reactive J. E. Huhecy & E. A. Keiter

VEER NARMADA SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

Chemistry

Paper – VII (Organic Chemistry)

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

52 Marks (External) Total 60 Hrs
23 Marks(Internal) Time 3 Hrs.
(Uni. Exam)

UNIT – I

Topic –1: Reaction Mechanism 7 Hrs

(a) Different types of mechanism for esterification and hydroysis

BAc^2 AAc^2 AAc^1 AAL^1 BBL^1 BAl^2

(b) Mechanism of formation and hydrolysis of amides.
(c) Mechanism of hydrolysis of acid anhydrides and acid chlorides.
(d) Pyrolytic eliminations: pyrolysis of acetates Cope and Chugaev reaction.

Topic –2: Molecular rearrangments 5 Hrs

(a) Mechanism of rearrangements involving C to C migrations as illustrated by Wagner – Meerwein and pinocol-pinacolone rearrangements.
(b) Mechanism of rearrangements involving C to N migrations as illustrated by Hoffmann, Curtius , Schmidt and Beckmann rearrangements.

UNIT – II

Topic –1: Alkaloids: 6 Hrs

The occurance , classification , general methods, to determine their structure , analytical and synthetic evidence to prove the structure of nicotine , cocaine , piperine, and papavarine.

Topic –2: Vitamin and Hormones: 3 Hrs

Structural determinations of Pyriodoxine and Thyroxine and their synthesis
General introduction and synthesis of Ribofllevin & Vitamin-A.

Topic –3: Hetero cyclic compounds: 3 Hrs

Introduction, M. O. picture and aromatic characteristics of pyrrole, thiophene, and pyridine, method of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reactions in pyridine derivatives.

UNIT – III

Topic –1: Terpenoids (Isoprenoids): 5 Hrs

Their occurance , classification , isoprene and special isoprene rule , general methods to determine their structure , analytical and synthetic evidences for the structure of Limonene, Camphor, Pinene & Citral.

Topic –2: Synthetic dyes:(Colour and constitution electronic concepts) 3 Hrs

Definition and difference between dyes and pigments, classification of dyes , color and constitution –Witt's theory, synthesis and uses of Eriochrome black-T , Congo red , Crystal violet , Eosin, Indigo, Methylene blue, Caledon Jade Green and Alizarine.

Topic –3: Synthetic polymers: 4 Hrs

Addition or chain growth polymerisation , free radical vinyl polymerisation and Ionic vinyl polymerisation, Ziegler – Natta Polymerisation and Vinyl polymers Condensation or step growth Polymerization , Polyesters , Polyamides, Phenol Fomaldehyde , Resins, Urea, Formaldehyde Resins , Epoxy resins , Natural and Synthetic rubbers.

UNIT – IV

Topic –1: Synthetic drugs : 4 Hrs

Their classification , based on pharmacological action, synthesis and uses of Pyrimethamine , Luminal , Diazepam, Novalgin, Mabendazole, Haloperidol, Chloramphenicol, Lidocaine, Sulfadoxine, Chloropropamide, Dapsone, Pethidine

Topic –2: Plant pigments : 5 Hrs

(a) classification

(b) Carotenoids: General , analytical and synthetic evidence for the structure of B-carotene.

(c) General account of anthocyanidins and flavones including structural variations, general method for determining the structures of anthocyanidins and flavones , structure and synthesis of cyaniding chloride and quercetin, synthesis of substituted acetophenones and benzaldehydes as intermediates.

Topic –3: Carbohydrates : 3 Hrs

Classification and nomenclature, chain lengthening and chain-shortening of aldoses, configuration of monosaccharides, introduction to disaccharides, struture determination of maltose and lactose.

UNIT – V

Topic –1: Spectroscopy : 8 Hrs

(a) Infrared (IR) absorption spectroscopy terms, instrumentation molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum finger prints region , charactoristic absorption of various functional groups and interpretaion of IR spectrum of simple organic compounds.

(b) Nuclear magnetic resonance (NMR) spectroscopy , proton magnetic resonance (^{1}H NMR) spectroscopy, Nuclear shielding and deshielding, chemical shift and molecule

structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde , 1,1,2-tribromoethane , ethyl acetate , toluene and acetophenon.

Topic –2: Poly peptides : 4 Hrs

Definition , peptide structure determination , Sangers method, Edman method , N-terminal determination , C-terminal determination by generation of amino alcohol and using digestive enzymes., End group anylisis , selective hydrolysis of peptides classical levels of protein structure , protein denaturation /renaturation.

Reference Books:

(1) Mechanism and Structure in organic chemistry-Goulde. S.
(2) Reaction mechanism in organic chemistry by Mukhargy & Singh
(3) Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla
(4) Organic reaction mechanism by Bansal Tata Mac. Hill
(5) Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar.
(6) Organic Chemistry by Hendrickson, Cram & Hammond
(7) Organic Chemistry by Brown R. F.
(8) Organic Chemistry by Solomon W. Graham
(9) Principles of Organic Synthesis- R. O. C. Norman
(10) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin
(11) May's Chemistry of synthetic Drugs by Dyson.
(12) Chemistry of drugs , Ener and Caldwell
(13) Synthetic drugs by Tyagi and Yadav.
(14) Chemistry of synthetic Dyes Vol. I & II by Venkatraman
(15) Synthetic Organic Chemistry by O. P. Agarwal
(16) Synthetic Dyes by Chatwal & Anand
(17) Spectrometric identification of organic compounds. By Silvestein , Bassler , Monill.
(18) Chemistry of synthetic Dyes by I. G. Vashi
(19) Organic Chemistry by Morrison and Boyd.
(20) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
(21) Spectra and Structure by P. S. Satpanthi
(22) Chemistry of synthetic drugs by Trivedi

VEER NARMADA SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

Chemistry

Paper – VIII (Physical Chemistry)

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

52 Marks (External) Total 60 Hrs

23 Marks(Internal) Time 3 Hrs.

(Uni. Exam)

UNIT – I

Thermodynamics: 12 Hrs

Partial molal free energy (chemical potential) Gibbs – Duhem equation , variation of chemical potential with temperature and pressure , chemical potential in case of a system of ideal gas mixture of two compounds.

Concept of fugacity , fugacity function , fugacity at low pressures, fugacity in gaseous mixture , physical significance of fugacity , method of determining fugacity – graphical method , method of equation of state approximate calculation method , fugacity of compounds in a mixture of solution , Lewis fugacity rule , Lewis –Randall rule , determination of fugacity in a mixture.

Concept of activity and activity coefficient , standard state, standard state of liquid , solid and gas method of determining activity and activity coefficient –from e.m.f. measurements only, variation of activity of a gas with pressure and temp.

The Nernst Heat theorem (NHT) , limiations of N. H. T. , proof of N. H. T. , the third law of thermodynamics, consequence of third law of thermodynamics , determination of absolute entropy of gases and liquids , applications of third law of thermodynamics , exceptions to third law of thermodynamics, numericals.

UNIT – II

(1)Electrochemistry: 8 Hrs

Electrochemical process , Deniell cell, E.M.F. of a cell and its measurements , standard cell , different types of reversible electrodes , electrochemical cells and sign convention , reactions in reversible cells, free energy change and electrical energy , single electrode potentials sign of electrode potential , calculation of electrode potentials , standard electrode potential (Oxidation and reduction) , electrochemical series, calculation of standard e.m.f. cell and determination of cell reaction , prediction of spontaneity of the cell reaction , determination of standard free energy change and equilibrium constant , hydrogen and calomel electrodes.

Concentration cell with and without transference, liquid junction potential , salt bridge,

Measurement of E M F with & without liquid junction potential,measurement of E M F of concentration cell without transference, numericals problems.

(2)Polymer chemistry: 4 Hrs

Introduction, all types of classification, chain polymersation , step polymersation , graft and block polymersation, average molecular wt. , number average and wt. average molecular wt., experimental methods to determine molecular wt. –osmotic pressure method , sedimentation method , viscosity method, numerical problems.

UNIT – III

(1)Electrochemistry II: 6 Hrs

Application of measurements of e.m.f. in the determination of :

(i) solubility product and solubility of sparingly soluble salts

(ii) Formula of silver complex ion (anion)

(iii) Ionic product of water by Galvenic cell and conc. Cell.

(iv) Transport number of ions.

(v) Equilibrium constant

(vi)pH by hydrogen, glass and quinhydrone electrodes with neumerical problem,

Decomposition voltage , overvoltage , hydrogen overvoltage in particular.

(2)Solutions : 6 Hrs

Definition of terms : solute , solvent & solution , composition of solution –Normal solution , molar solution , molal solution , mole fraction , saturated unsaturated and supersaturated solution, percentage solutions , solubility.

Liquid-liquid mixtures: Ideal liquid mixtures , Raoult's law , Henry's Law along with different forms , non ideal or real solutions, positive and negative deviations from Raoult's law , temperature composition curves for ideal & non ideal binary solution of miscible liquids , azeotropes.

Partially miscible liquids: phenol + water system.

Immiscible liquids: steam distillation, (numerical problems w.r.t. steam distillation, molar , molal concentrations and mole fraction).

UNIT – IV

Nuclear chemistry: 12 Hrs

Stable and unstable isotopes , separation of isotopes by different methods gaseous diffusion , thermal diffusion , distillation , chemical exchange methods , Bainbridge velocity focusing mass spectro graph, Dempsters direction focusing mass spectrometer, application of radio isotopes as tracer in medicine, agriculture , in studying reaction mechanism in photosynthesis and Friedle-Craft's reaction and age determination by C^{14} – dating method.

Particle accelerators: -linear accelerator , cyclotron , discovery of artificial disintigration, classification of nuclear reactions – based on overall energy transformations and –particles used as projectiles the merits and demerits of different projectiles , transuranic elements and detection and measurements of nuclear radiation by Geiger –Mullar counter.

Q Value of nuclear reactions, chemical and physical atomic wt. scale, mass defect and binding energy , packing fraction and its relation with the stability of the nucleus , nuclear fission, atom bomb , nuclear reactor for power generation and critical mass , nuclear fusion reactions , stellar energy and hydrogen bomb, hazards of nuclear radiation.

Numerical problems on Q-value , binding energy , packing fraction and energy released during nuclear reactions.

UNIT – V

(1) Crystal structure : 4 Hrs

Difference between crystalline and amorphous state , symmetry in crystals , types of crystals with illustration, law of Crystallography – Steno's law and law of constancy of symmetry , lattice planes , lattice paints , unit cell , Miller's indices , types of cubic systems and diagramatic representation of cubic system , and d_{100}, d_{110}, and d_{111} planes, Bragg's equation (X-ray diffraction) , Bragg's spectrometer for the determination of structure of Rock salt (NaCl) and Sylvine (KCl) .

(2) Phase equilibria : 8 Hrs

Statement and meaning of the terms phase , component , degree of freedom , phase rule , phase equilibria of one component system –water and sulphur system.
Phase equilibria of two component systems – simple eutectic Pb - Ag system , desilverisation of lead , KI water system , freezing mixtures
Solid solutions: compounds with congruent melting point (Mg-Zn) system and incongruent melting point (sodium chloride water) system

Reference Books:

(1) Elements of physical chemistry , by Glasstone and Lewis
(2) Physical Chemistry by G. M. Barrow
(3) Physical Chemistry by W. Moore
(4) Physical Chemistry by B. K. Sharma
(5) Physical chemistry by Puri, Pathania , Sharma
(6) Essential of Physical chemistry by Bahl and Tuli.
(7) Physical Chemistry by Negi & Anand
(8) Physical Chemistry by Baliga, Dhavale – Zaveri
(9) Nuclear Chemstry by Arnikar.

VEER NARMADA SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

Chemistry

Paper – IX (INDUSTRIAL & ANALYTICAL CHEMISTRY)

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

54 Marks (External) Total 60 Hrs
21 Marks(Internal) Time 3 Hrs.
(Uni. Exam)

SECTION – I, INDUSTRIAL CHEMISTRY MARKS – 22

HOURS – 24

UNIT - I

Topic-1:Sugar Industry: 4 Hrs

Manufacture of Sugar from cane, Importance of CaCO3, H3PO4, Defication, Carbonation / Sulphitation, Crystallisation, Refining of sugar by Bone-char process and Activated carbon powder process. Present position of sugar industry in India.

Topic-2:.Fermentation Industry: 4 Hrs

Introduction, Definition, Conditions favourable for fermentation (Temperature, Presence of other substances, Absence of preservatives, Concentration)
Ethanol, Citric acid, Acetone & Butanol from molasses, Penicillin-G

Topic-3: Manufacture with flow sheet's and uses of; 4 Hrs

Bisphenol-A, Acrylonitrile from acetylene, Styrene, Chloroprene, H-acid

UNIT – II

Topic-1: Pulp and Paper industry: 4 Hrs

Introduction, Types of pulp, Manufacture of chemical pulp by Sulphate pulp process, Sulphite pulp process, Soda pulp process, Manufacture of paper –Conversion of pulp into paper- Beating process. Importance of Filling, Sizing, Colouring materials in the manufacture of paper, Calndering, Position of paper industry in Gujarat & India

Topic-2: Fluorocarbons: 4 Hrs

Chloro-fluoro derivatives of Methane & Ethane used as Freons., Uses of Freons and Freon-12.

Manufacture of HF from Fluor-spar, Manufacture of Freon-12 from Carbon tetrachloride using HF
Manufacture of Freon-12 from Vinylidine fluoride, Pollution hazardness of Fluorohydrocarbons.

Topic-3:Unit processe in organic synthesis: 4 Hrs

Nitration- Definition, Nitrating agents, Factors affecting the nitration, Nitration of Benzene, Phenol, Toluene, Naphthalene,
Importance of nitration in the manufacture of –
Artificial perfumes- Musk xylene, Musk ketone, Musk ambrette,
Explosives -Trinitro phenol, Trinitro toluene, Trinitro glycerine, Ammitol, Tetranitromethane ,

Amination- Definition, **Amination by Reduction** - Metal Acid Reduction, Metal Alkali Reduction, Sulphide Reduction, Catalytic Reduction
Amination by Ammonolysis, e.g. Amination of Chlorobenzene, 2;4,dinitro chlorobenzene, Phenol, Naphthols.
Importance of Amination in industry in the manufacture of Sulphanilamide and Benzidine from nitrobenzene, m-Phenylene diamine from m-nitro aniline, Benzoquinone from p-nitro chlorobenzine, Sachcharin , HMDA, Anthranilic acid , Hexamethylene tetramine

SECTION – II, ANALYTICAL CHEMISTRY MARKS – 32

HOURS – 36

Unit III

Topic-1: Treatment of Analytical data Errors : 6 Hrs

Definition :

Types of errors: Determinates errors, indeterminates errors, constant and proportional errors.

Define and explain the following terms – Accuracy and Precision , mean , median , deviation , average deviation , standard deviation , varience ,coefficient of variation , relative mean deviation , range , absolute errors , relative errors , meanimisation of determinates errors ,rejection of result from a set of results,

2.5 d rule, 4.0 d rule and Q-test

(Problems based on above topics)

Topic-2: Gravimetric analysis : 6 Hrs

Factors affecting solubility of precipitates.

(1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation

The precipitation process and particle size. Nucleation and particle growth. Von Weimarh's theory of relative super saturation . digestion of precipitates – Co- precipitation and post precipitation – precipitation from homogeneous solution.
Thermogravimetry, general principle , application with following two specific examples

(1) Cac2O4, H2O (2) $MgC2O_4$, $2H_2O$ [No instrumentation]

Unit IV

Topic-1: Titrimetric analysis : 12 Hrs

(1) General: Titrimetric methods, primary standards and standardization of solutions.
(2) Acid base titration , titration of polyprotic acids with strong base , construction of titration curves , titration of carbomixtures
(3) Precipitation titrations, detection of end points by Mohr's method , Volhard's method , K.Fajan's method.
Application of each types.
(4) Redox titrations :- construction of titration curves, detection of end points , types of indicators, theory of true Redox indicators , oxidants – KMnO4, K2Cr2O7 , Reductance – Iodide , sodium arsenite
(5) Complexometric titrations : - EDTA titration , absolute and conditional stability constant , Deriving factors : α_4 for effect of pH., β_4 for the effect of auxillary complexing agent.
Titration curves: Theory of metallochromic indicators , Masking , dmasking and kinetic masking .
Types of EDTA titrations.
Problems based on all above topics.

Unit V

Topic-1: Modern method of analysis : 4 Hrs

Spectrophotometry: (a) components of spectrometer –block diagram and working of single beam spectrophotometer , spectronic-20. (b) analytical application of spectrophotometry –(Beer's law and terms involved) . analysis of unknown calibration curves method, standard edition method , and ratio method . determination of Cu+2, Fe+3, NO2-1, NH3 using spectrophotometry .
Problems based on quantitative analysis.

Topic-2: Gas chromatography : 4Hrs

Classification of chromatography –principles of GC sepration –components of GC carrier gas and its selection –stationary phases : solid adsorbents inert supports and liquid stationary phases , detectors : FID, TCD, qualitative and quantitative analysis using GC.

Topic-3: Liquid chromatography : 4Hrs

Conventional liquid chromatography limitations technique of HPLC elementary idea about technique and layout diagrams of instrument . components of instrument TLC technique.

Reference Books:

(1) Shreve Chemical Process Industries 5 ed. George. T. Austin . Mag. Hill. Book Agency
(2)Reigel's Industrial Chemistry Ed. By James A. Kent.
(3) Unit Process in Organic Synthesis by D. H. Groggins.

(4) An Introduction to Industrial Chemistry by Peter Wiseman , Applied Science Pub. Ltd. London.
(5) Industrial Chemistry by B. K. Sharma Goel Pub.
(6) Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India ltd.
(7) Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
(8) Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
(9) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
(10) Instrumental Methods of Analysis by B. K. Sharma

VEER NARMADA SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

Chemistry

Practical

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

140 Marks (External)
60 Marks(Internal)
Time 21 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}

BORATE- Boric Acid

CHROMATE – Na+1, K+1

Inorganic qualitative analysis of mixture containing six radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid including Chromate and Borate.

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

VOLUMETRIC EXERCISE (ANY SIX TO BE DONE)

To determine the percentage purity of potassium acid phthalate

To determine the amount of Ammonium sulphate in the given solution.

To determine the amount of Bismuth by E D T A

To determine the amount of Ferric by E D T A

To determone the amount of Chromium by E D T A

To determine the amount of Nickel with Magnesium by E D T A

To determine the amount of Chloride by Mohr's method OR Absorption indicator

To determine the amount of Bromide by Vohlard's method OR Absorption indicator

To determine the percentage purity of $NaNO_2$ / KNO_2

GRAVIMETRIC ESTIMATIONS

Gravimetric Estimation of Fe^{+2} as Fe_2O_3 from Fe-NH_4-SO_4 + $CuSO_4$

Ba^{+2} $BaSO_4$ from $BaCl_2$ + $FeCl_3$

Al^{+3} Al_2O_3 from $Al_2(SO_4)_3$ + $CuSO_4$

Estimation of Alloy

Brass -Zinc as $Zn_2P_2O_7$ gravimetrically & Copper by iodometrically(volumetric)

German silver - Nickel as Ni (D M G)$_2$ gravimetrically & Copper by iodometrically(volumetric)

ORGANIC SEPARATION

Separation of binary mixture, identification of the components and its crystallization & preparation of one derivative and its purification.

ACID – Succinic acid, Benzoic acid, Salicylic acid, Phthalic acid, Cinnamic acid, Phenyl acetic acid,

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

PHENOL – Resorcinol, Phenol, Alpha naphthol, Beta naphthol, o – Nitro phenol, m – Nitrophenol.

NEUTRAL –

ALDEHYDE – Benzaldehyde

KETONE – Acetone, Methyl Ethyl ketone, Acetophenone,

ESTER – Methyl acetate, Ethylacetate, Butylacetate

ALCOHOL – Methanol, Ethanol

HYDROCARBON – Benzene, p-Xylene, Toluene, Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON – Nitro benzene, m – Dinitro benzene

HALOGENATED HYDROCARBON – Chloroform, Carbon tetrachloride, Chlorobenzene, Bromobenzene, P – Dichlorobenzene

AMIDE – Benzamide, Urea, Thiourea

ANILIDE – Acetanilide

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

ORGANIC ESTIMATIONS

Determination of percentage purity of Vitamin -C

Determination of saponification value of an oil

Determination of percentage purity of Aspirin

Determination of amount of Formaldehyde in given solution

Determination of amount of Ethyl acetate in the given solution

Determination of amount of Glycine in the given solution

(Instead of sample weighing , solutions to be given)

CHROMATOGRAPHY

Chromatographic separation of amino acid mixture by ascending paper chromatography

Glycine + Methionine

Alanine + Methionine

Alanine + Valine

PHYSICAL PRACTICALS

Refractometer

1. To determine the specific refractivities of the given liquids A, .B and their mixtures containing 20%, 40% and 60% and unknown liquid by volume.

Surface Tension

2. To determine by the drop number method the surface tension of the liquids A, B & C Which are successively members of the homologous series. Calculate from the above results the contribution to the parachor value of CH_2 group.

To compare the cleansing power of two detergents by measuring the surface tension of their aqueous solution.

Polarimeter

3. To determine the angle of rotation of the given substance (sugar / glucose / tartaric acid) using three different dilutions. Determine the concentration of given unknown solution of the same substance

Chemical Kinetics:

4.To investigate the reaction between $K_2S_2O_8$ & KI

5.To investigate the reaction between $KBRO_3$ & KI

6.To investigate the reaction between H_2O_2 & KI

pH metry (ANY TWO)

7.To measure the pH of different buffer solutions and to study their buffer capacity.

8.To determine the degree of ionisation of HAc and NH4OH.

9.To determine the dissociation constant of a weak acid by titration of weak acid and strong base.

10.To determine the ionisation constant of HAc and NH_4OH PH Metrically

Potentiometry(ANY TWO)

11.To determine the Normality of given HCl solution Potentiometrically using 0.5^N NaOH.

12.To determine the Normality of Fe-NH_4-SO_4 Potentiometrically using $K_2Cr_2O_7$ solution.

13. To determine the solubility and solubility product of a sparingly soluble salt (AgCl) Potentiometrically by titration of Ag NO3 & NaCl

Conductometry Titration (ANY TWO)

14. To determine the amount of $BaCl_2$ in the given solution conductometrically using K_2CrO_4

solution.

15. To determine the amount of NaCl in the given solution conductometrically using $AgNO_3$ solution.

16.To determine the amount of Vanillin or % Purity of Vanillin cinductometrically.

17. To determine the amount in the given mixture of (HCl + HAc) solution conductometrically using

Std. NaOH Soln..