

BHARATHIAR UNIVERSITY, COIMBATORE.
B.Sc. Chemistry
(revised papers with effect from 2015-16 onwards)

Note: The revised syllabi for the following papers furnished below be followed and there is no change in the existing scheme of examination and syllabi of remaining papers.

CORE II - CHEMISTRY PAPER II

Teaching hours: 60 hours per semester

Subject description:

This paper presents the concept of coordination chemistry, aromaticity and thermodynamics.

Goals:

To enable the students to learn about aromaticity, thermodynamics and coordination chemistry.

Objectives:

To study the principles of thermodynamics and coordination chemistry.

Contents

Unit I:

. Acids and bases; Definitions- different approaches to protonic acid – base systems – strengths of Lewis Acids and Bases -Hard and Soft Acids and Bases. Applications of HSAB concept Basis of hardness and softness, limitations of HSAB concept.

Unit II:

Chemistry of Boron family – Group discussion – Electron acceptor behaviour and electron deficiency of boron hydrides; bonding in diboranes; NaBH_4 , LiBH_4 preparation, properties, structure and uses- borozoels, borides.

Classification of silicate- simple silicates chain silicates and sheet silicates only.

Unit III:

Structure of benzene-Electrophilic substitution in benzene with mechanisim-Aromaticity-Huckel's rule. Grignard reagents and synthetic applications-Nucleophilic substitution reaction – $\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$ and $\text{S}_{\text{N}}i$ reactions – Elimination versus substitution-Benzyne mechanism and intermediate complex mechanism.

Unit IV:

The laws of thermodynamics, generalities and Zeroth law – kinds of energy – Scope of the first and second laws of thermodynamics-thermodynamic terms-definitions – heat – work of expansion – work of compression – maximum and minimum quantities of work – Reversible and irreversible transformations – energy and first law of thermodynamics – properties of energy changes in relation to properties of system is thermal and adiabatic changes – meaning of the thermodynamic state function & path function – Joule Thomson experiment Relation between E and H, C_p and C_v .

Unit V:

Application of the first law of thermodynamics to chemical reactions. The heat of reaction – conventional value of H . The determination of heats of formation – sequences of reactions – Hess's law – heats of combustions – determination by Bomb Calorimeter – Bond energies – Resonance energies – Heats of solution – integral and differential dilution – Heats of reaction at constant volume – dependence of the heat of reaction on temperature and Kirchoff's equation.

TEXTBOOKS FOR REFERENCE:

1. Principles of Inorganic Chemistry, B.R. Puri L.R. Sharma, Shobanlal Nagin Chand & Co.
2. Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons.
3. Organic Chemistry, Vol. 1, 2, 3, S. M. Mugherjee, S.P. Singh, R.P. Kapoor, Wiley Eastern.
4. Advanced Organic Chemistry, B.S. Bahl, Arun bahl, S.Chand & Co.
5. Essentials of Physical Chemistry, B.S. Bahl and G.D. Tuli, S.Chand & Co.
6. Text book of Physical Chemistry, P.L.Soni, D.B. Dharmarke, Sultan Chand & Sons.

CORE IV - CHEMISTRY PAPER III
Teaching hours: 45 hours per semester (3 hours per week)

Subject description:

This paper presents the principle in the extraction of metals and mechanism of some important organic reactions.

Goals:

To enable the students to learn about the extraction principles and mechanism of some addition reaction.

Objectives:

To understand the mechanism and synthetic uses of important organic reactions.

Contents:

Unit I:

General methods of Extraction: Concentration – Gravity separation, Froth Floatations magnetic separation, Extraction – Chemical and Electrolytic methods of refining, Zone refining, Van Arkel refining and Electrolytic refining with examples.

UNIT II

Occurrence, extraction, properties and uses of Thallium, Germanium, Titanium and Tin - their important compounds such as GeCl_4 , TiO_2 , TiCl_4 , and SnCl_2 .

Unit III:

Chemistry of Carbonyl Compounds – I:

Reaction mechanisms: Nucleophilic addition of Grignard reagent, NH_3 , primary amine- Aldol condensation, Cannizzaro reaction, Perkin reaction, Knoevenagel reaction and Claisen-Schmidt reaction.

Unit IV:

Chemistry of Carbonyl Compounds – II

Reaction mechanisms – Reformatsky reaction, benzoin condensation, Wittig reaction, haloform reaction – Reaction with LiAlH_4 and NaBH_4 – Clemmensen reduction, Wolff Kishner reduction, MPV reduction – reducing properties of Carbonyl compounds.

Unit V:

Malonic ester, acetoacetic ester and cyanoacetic ester-their preparation and synthetic applications Tautomerism of acetoacetic ester.

Geometrical isomerism – Cis & Trans, E & Z notations – Geometrical isomerism in maleic acid and fumaric acid - physical and chemical properties of geometrical isomers.

CORE V – CHEMISTRY PAPER IV

Teaching hours: 45 hours per semester (3 hours per week)

Subject description

This paper presents the basic aspects of thermodynamics, adsorption, chromatography and computer programming.

Goals

To enable the students to understand the laws of thermodynamics, adsorption and the Computer C Programming.

Objectives

To study the applications of computer programming in chemistry and the importance of send and thermodynamics, adsorption and chromatography.

UNIT I:

Introduction to second law of thermodynamics – Carnot cycle – entropy – Definition – Entropy changes in isothermal transformation – Trouton's rule. Entropy as function of T and V – Entropy as a function of T and P – Changes of entropy with T, Entropy changes in ideal gas – entropy of mixing of ideal gases.

UNIT II

General conditions of equilibrium and spontaneity- conditions of equilibrium and spontaneity under constants – definition of A and G – physical significance of – dA and dG.

Temperature and pressure dependence of G – Gibbs – Helmholtz equation. Chemical equilibrium – The concept of chemical potential – chemical potential in a mixture of ideal gases – van't Hoff Isotherm and isochore – Third law of thermodynamics – statement and applications. Exception to third law.

UNIT III ADSORPTION AND CATALYSIS

Adsorption – types, differences between chemisorption and physisorption – Adsorption of Gases by solids – Adsorption isotherms – Freundlich, Langmuir isotherms derivations – BET EQUATION (Derivation not required) – Adsorption from solutions – ion exchange adsorption Types and applications – Techniques to determine the adsorbed molecules on solid surfaces.

Catalysis – classification – differences between Homogeneous and Heterogeneous catalysis – Acid Base catalysis – Kinetics and Mechanisms – Autocatalysis – Enzyme catalysis Characteristics and mechanism - Michaelis – Menton equation.

UNIT IV

CHROMATOGRAPHY

Chromatographic methods – Partition Adsorption – Basic principles – Differential migration, adsorption phenomenon, nature of adsorbents, choice of solvents and R_f value – Techniques and applications of Paper, Column and TLC – Gas chromatography and HPLC (Basic principles only).

UNIT V : C program for chemistry

Structure of C program, Variables in C, C Keywords and constants in C. Operators in C – Arithmetic, Increment, Decrement, relational and logical operators.

Program: To calculate the pH of solutions and to find that it is basic, acidic or neutral –
Calculation of pH of solution using Henderson equation- to compute the rate constant of a first
order reaction – to compute the energy of activation of a reaction.

REFERENCES:

- 1 .Principles of physical chemistry, B.P.Puri, L.R.Sharma and M.S.Phathania, Shobanlal Nagin Chand & Co.
2. Physical chemistry G,W.Castelan, Narosa publishers.
3. Physical chemistry(voll) – N.B.Singh, ShivasaranDas,A.K.Singh –New Age International Publishers – First edition(2009)
4. Introduction to Chromatography – V.K.Srivatsava and K.K.Srivatsava – S.Chand& Company – Second edition(1981)
5. Computer for chemists – By PundirBansal – PragatiPrakasam Pubs

CORE IX - CHEMISTRY PAPER VII

Teaching hour : 60 hours per square (4 hours per week)

Subject description

This paper presents the chemistry of carbohydrate, molecular rearrangements, amino acids and hetero cyclic compound.

Goals

To enable the students to learn about carbohydrates, amino acids and hetero cyclic compounds.

Objectives

To understand the importance of carbohydrate, amino acids in chemistry.

Contents

UNIT I :

Optical activity of compounds with asymmetric carbon- racemisation – resolution – asymmetric synthesis- configuration D,L and R,S. nomenclature. Optical activity due to restricted rotation of biphenyls, allenes and spiranes.

UNIT II :

Mechanism of molecular rearrangement reaction: Pinacol Pinacolone, Beckmann, Hoffmann, Curtius, Benzilic acid, Schmidt, Lossen, Cope, Benzidine and Claisen rearrangements.

UNIT III :

Carbohydrates: Chemistry and structure of Glucose, Fructose, Sucrose and Maltose (cyclic structure as well;). Starch and Cellulose. An elementary account. (Elucidation of structure not necessary)

Inter conversion of sugars-mutarotation – Epimerisation.

UNIT IV :

Amino acids and proteins

Amino acids-Classification –Preparation and properties peptides and poly peptides- proteins classification based on physical properties and biological functions-primary secondary and tertiary structure – properties and uses.

UNIT V :

Heterocyclic compounds

Chemistry of Furan, Pyrrole, Thiophene, Quinoline, Isoquinoline, Benzofuran, Indole, Isatin and Indigo.

CORE X - CHEMISTRY PAPER VIII

Teaching hour : 60 hours per semester (4 hours per week)

Subject description

This paper presents the principles of conduction Electro motive force, fuel cells.

Goals To enable the students to know about electro chemistry.

Objectives To study EMF, pH and their applications.

Contents

UNIT I:

Electrical conduction, conduction in metals and in electrolytic solutions. Measurement of conductivity in electrolytic solutions. Migration of ions-Kohlrausch's law. Arrhenius theory of electrolytic dissociation-Oswald's dilution law. Theory of strong electrolytes-Debye-Huckel-Onsagar theory (elementary account only) verification Debye-Falkenhagen effect-Wien effect-Transport numbers-Determination conductometric titrations.

UNIT II:

Ionic Equilibria-Solubility and solubility product-determination of solubility product-Applications of solubility product principles. Dissociation of weak acids and bases-Dissociation constants-pH scale-commonion effect-buffersolutions- Determination of pH values of Buffer mixtures-Henderson's equation-Hydrolysis of salts-Degree of hydrolysis.

UNIT III:

Electrochemical cells. Electrode potentials-The standard hydrogen electrode kinds of electrodes and their potentials-Nernst equation. EMF-computation and measurement of cell EMF single electrode potential-Determination and significance of electrode potentials- electro chemical series- temperature dependence of the cell EMF- Thermodynamic quantities of cell reactions.

UNIT IV:

Reference electrodes-Electrodes for measurement of pH-concentration cells with and without transport-liquid junction potential-applications of EMF measurements. Redox potential-Redox indicators-uses. Potentiometric titrations.

UNIT V:

Fuel cells: Hydrogen- oxygen cell and hydrocarbon oxygen cell. Storage cells. Lead storage cell, Nickel-cadmium and lithium-ion cell. Decomposition voltage-over voltage-Depositions and discharge potential – Electrochemical Principle of corrosion.

CORE XII - CHEMISTRY PAPER X

Teaching hours: 75 Hours per semester (5 hours per week)

Subject description

This paper represents the principles of spectroscopy and The chemistry of natural products.

Goals

To enable the students to know about terpenoids, vitamins, alkaloids and harmones.

Objectives

To study the spectroscopy and natural products

Contents

UNIT I :

Spectroscopy absorption spectra – fundamental concepts electromagnetic Spectrum-the various regions of the spectrum and the relative energies of the radiation in each region-type of changes induced by the interaction of radiation with matter. Theory of rotations spectra-Molecular rotation-diatomic molecule as rigid rotor-diatomic molecule as non-rigid rotor-intensities of spectral lines. Applications of rotation spectra bond length-isotopic substitution.

UNIT II :

Theories of IR spectra-simple harmonic oscillator model-An harmonic oscillator model of diatomic molecules information on molecular constitution from IR spectra; Application of IR spectra. Theory of Raman spectra-comparison of IR and Raman spectra Theory of UV and visible spectra-Frank Condon principle-Pre dissociation-determination of dissociation energies –Applications of UV spectra.

UNIT III :

NMR SPECTRASCOPIY: Principles, instrumentation (Block diagram) – chemical shift – importance of TMS – factors influencing chemical shift – spin spin splitting and coupling constant – Applications of NMR to simple molecules like ethyl alcohol (Pure and Impure), toluene, propane, phenol, chloroethane and acetaldehyde.

UNIT IV :

Terpenoids; Introduction-Classification-General methods of isolation-isoprene rule-structural elucidation and synthesis of gernaol, terpeneol, dipentene and alpha pinene.

Vitamins-introduction-importance of vitamins-structural elucidation and synthesis of Retinol, Thiamine, Riboflavin, Ascorbic acid.

UNIT V :

Alkaloids – introduction – classification – General characteristics – general methods of determining structures- Hoffmann’s exhaustive methylation structural elucidation and synthesis of Nicotine, conine, piperine and papaverin.

Harmones; Introduction-Structural elucidation and synthesis of adrenaline and thyroxine.

TEXTILE CHEMISTRY PAPER – IV
TEXTILE CHEMISTRY – PRACTICAL

Lab- hours : 30 Hours per semester (2 hours per week)

LIST OF EXPERIMENTS

1. Estimation of pH- paper, digital pH meter, pH solution
2. Volumetric analysis of Sodium Nitrite
3. Estimation of available chlorine in bleaching powder
4. Analysis of acidity of water by volumetry
5. Analysis of alkalinity of water by volumetry

PREPARATION OF DYES

1. Methyl Red
2. Malachite Green
3. Methyl Orange
4. Pare nitro benzene azo beta naphthol
5. Azo amino benzene.