

Krantiguru Shyamji Krishna Verma

Kachchh University

Mundra Road

BHUJ : 370 001



SYLLABUS

B. Sc. Semester V : (FIVE)

CHEMISTRY

THREE Papers :

Code No : CECH-507 (Inorganic Chemistry)

Code No : CECH-508 (Organic Chemistry)

Code No : CECH-509 (Physical Chemistry)

With effect from June 2016

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KACHCHH UNIVERSITY: BHUJ
B.Sc. SEMESTER: V (FIVE) CHEMISTRY PAPER : VII (wef June 2016)

Paper Code NO. : CECH-507 (INORGANIC CHEMISTRY) M. M. : 60
Examination Time : Two Hours

UNIT : I : Quantum Chemistry : (15 M)

Setting up of Operators for observables, Time – dependant Schrodinger wave equation, Elimination of Time part, Stationary states, Important theorems concerning Hermitian operators, Particle in a three dimensional box, Separation of variables, Eigen functions and Eigen values, Symmetry and degeneracy.

Rigid rotator problem, Application to rotation spectra of diatomic molecules, Schrodinger equation in spherical polar co-ordinates for hydrogen atom, Separation of variables, solution of ϕ and Φ equation, Total energy of Hydrogen atom as per the variation method and the secular equation.

Ref. Books :

- (1) Introductory Quantum Chemistry : A K Chandra , 5th ed, Mc Graw Hill (1998)
- (2) Quantum mechanics in Chemistry : Melvin W Hanne
- (3) Chemical Bonding : An Introduction : A K Raval , K C Patel, & R D Patel
- (4) Theoretical Inorganic Chemistry : Dey & Selbin

UNIT : II : Chemical Bonding :

(A) Molecular orbital treatment for square planar, tetrahedral and Octahedral complexes, Molecular orbital treatment of polyatomic molecules CH_4 , H_2O and NH_3 . (8 M)

(B) Three centered bonds in B_2H_6 and structure of Boranes , MO treatment for complexes such as $[\text{Pt Cl}_4]^{-2}$, $[\text{NiF}_4]^{-2}$, $[\text{IrF}_6]^{-4}$, $[\text{Fe}(\text{CN})_6]^{-4}$, $[\text{FeF}_6]^{-3}$, $[\text{V}(\text{CN})_6]^{-3}$. Simple Huckel theory. (7 M)

Ref. Books:

- (1) Electron and Chemical Bonding : Harry B Grey
- (2) Valency and Molecular structure : E Cartmell and G W Fowels .3rd Ed, ELBS, Bucker Worth (1970)
- (3) Advanced Inorganic Chemistry : F A Cotton, and Wilkinson.

UNIT : III

(A) **Coordination Chemistry :** (8 M)

Reaction Kinetics and mechanisms, Trans effect and Trans influence, its application in synthesis, Mechanism of trans effect, Lability, Inertness, Stability and instability

(B) **Kinetics and Reaction rates of Substitution :** (7 M)

Ligands field effect and reaction rates, Mechanism of Substitution reaction, Substitution in Octahedral complexes, Substitution reaction in square planar complexes, Substitution in square planar Pt(II) complexes, substitution in Octahedral Co(III) complexes, Cis-effect Associative , Dissociative and SN-1 mechanism.

Ref Books :

- (1) Inorganic Chemistry : James E Huheey
- (2) Mechanism of Inorganic Reactions : Basolo & Pearson

UNIT : IV

(A) Metal Carbonyls : (5 M)

Mono and poly nuclear metal carbonyls such as $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Cr}(\text{CO})_6$, $\text{Fe}_3(\text{CO})_{12}$, $\text{Co}_2(\text{CO})_8$, $\text{Mn}_2(\text{CO})_{10}$, $\text{Ir}_4(\text{CO})_{12}$

Metal Nitrosyl and Metal Carbonyl hydrides, Application of IR spectra in the structure determination of metal carbonyls.

Ref Books :

- (1) Advanced Inorganic Chemistry : Cotton & Wilkinson, 3rd Ed, pages 683-698, 702- 706 , 713-715
- (2) Inorganic Chemistry : James E Huheey
- (3) Introduction to Advanced Inorganic Chemistry : Durrant & Durrant

(B) Magneto Chemistry and SHAB : (5 M)

Types of magnetic behaviour, Methods of determining magnetic susceptibility, Spin only formula, Correlation of μ_s and μ_{eff} values ; Hard –Soft Acids & Bases

(C) Organo metallic Compounds : (5M)

Definition, , Classification, Synthesis (General methods), Properties and Structure and Applications of Organo metallic compounds of Mg , Al and Be; OMC of first transition series elements.

MORE REFERENCE BOOKS:

- (1) Basic Inorganic Chemistry: F. Allert, Cotton, G. Wilkinson, P.L Gans
3rd Edition, John Willey, New York , 1995.
- (2) A New Concise Inorganic Chemistry , J.D Lee , 4th Edition ,1991 ELBS and D.van Nostrand company Ltd.
- (3) Principles of Inorganic Chemistry by Puri and Sharma ,29th Edition
- (4) Environmental Chemistry by A.K. Dey.

Pattern of Question paper for semester-end Examination. Paper code CECH:507

Total Marks : 60 , Duration : **TWO** Hours , Passing standard : 40% ie 24 Marks

Internal options are compulsory (i.e. Q.1 or Q.1; Q.2 or Q.2 etc. or attempt any 2 or any 3 out of given four or five)

There are four questions (Q. 1 to Q. 4) each carrying 15 marks. One main question from every unit.

The structure for the questions is as under:

Questions	Section	Marks
Question – 1 Unit – I	A (Short answers , <i>no internal option</i>)	5 marks
	B (Descriptive - Essay type - Short notes <i>with internal option</i>)	10 marks
Question – 2 Unit –II	A –do-	5 marks
	B –do-	10 marks
Question – 3 Unit – III	A –do-	5 marks
	B –do-	10 marks
Question – 4 Unit – IV	A –do-	5 marks
	B –do-	10 marks

Types of questions for section A are varied: like: one or two line answers/ definitions / reasoning/ mathematical equations/drawing small figures/ matching the answers etc.

KACHCHH UNIVERSITY : BHUJ

B.Sc. SEMESTER : V (FIVE) CHEMISTRY PAPER : VIII (wef June 2016)

Paper Code NO. : CECH-508 (ORGANIC CHEMISTRY) M. M. : 60

Examination Time : Two Hours

UNIT:I Stereo Chemistry :

(15 M)

Introduction, Types of Isomerism, Stereoisomerism, Optical Isomersim, Enantiomers, Diastereomers, meso compounds , Racemic mixture, D-L system, R-S system, E,Z system, Conformational analysis of Ethane, Butane, c-Hexane, Mono methyl c-Hexane, Dimethyl c-Hexanes, Stereochemistry of Oximes, Molecular asymmetry of Di phenyls and Allenes.

Stereo selective and stereo specific reactions : Stereo chemistry of addition of halogens to sym-alkenes. Syn and anti addition , Concept of pro-stereoisomerism and Chiral synthesis : Cram's Rule, Prelog's Rule and assignment of configuration.

UNIT:II:

(A) Nucleophilic reactions (Aliphatic) :

(7 M)

Definition, types of reactions , Discussion about SN-1 and SN-2 reaction (definition, mechanism, evidences, stereochemistry, graph etc) , Factors affecting the course and mode of SN reactions (Nature / structure of Substrate, nature of Nucleophile, Nature of leaving group, nature of solvent) , Neighbouring group participation , SN-i reaction, Walden inversion.

(B) Elimination reactions :

(4 M)

Definition, classification, discussion about E-1, E-2 and E-1CB mechanism, Carbonium ion rearrangement, Orientation of double bond in elimination reactions.

(C) Nucleophilic Aromatic substitution :

(4 M)

Definition, Bimolecular displacement and its mechanism, Reactivity, Orientation, Electron withdrawal by resonance, Evidence for two step mechanism. Benzyne Mechanism including structure of Benzyne and evidences.

Ref: Organic Chemistry : VI th ed , R T Morrison and R N Boyd , sec 26.1, 26.4 to 26.14

UNIT : III

(A) Isoprenoids (Terpenoids) :

(8 M)

Classification, general methods of determining structure of isoprenoids, Isoprene rules, Chemistry of Citral , α -Terpineol and Camphor with their synthesis , study of reactions of β - carotene (No synthesis)

Ref : Organic Chemistry : I L FinarAR , Vol.II , 5th Ed, pages 354-358, 361-365, 369-371, 392-395.

(B) Alkaloids :

(7 M)

Classification , Definition, General methods of determining structure, Structure of Coniine, Nicotine and Atropine including their synthesis.

Ref : Organic Chemistry : I L Finar, Vol.II, 5th Ed, pages 696-702, 713, 717-726

UNIT : IV**(A) Carbohydrates : Disaccharides :** (6 M)

Chemical reactions and structures of Maltose, Cellobiose, Lactose and Sucrose

Ref : Organic Chemistry : VI th ed , R T Morrison and R N Boyd , pages 1185-1192

(B) Heterocyclic compounds : (5 M)

Structure and aromaticity of Pyrrole, Furan and Thiophene, Electrophilic substitution reactions, Reactivity and Orientation, Structure of and aromatic characteristics of Pyridine, SE and SN reactions of Pyridine, Basicity of Pyridine, Synthesis and reactions of Quinoline and Isoquinoline, Synthesis of Pyrimidine, Uracil, Thymine and Cytosine.

(C) Name –reactions / rearrangements : (4 M)

Principle, Mechanism and synthetic applications of these reactions :

- (1) Pinacol-pinacolone rearrangement (2) Fries Migration (3) Hofmann reaction
(4) Dakin Reaction (5) Diels-Alder reaction

Reference Books : In general

- (1) Organic Chemistry : Morrison and Boyd , 6th or 7th Edition , Prentice Hall, New Delhi
- (2) A Text book of Organic Chemistry : P L SONI, Sultan Chand and sons, New Delhi
- (3) Name reactions and Mechanism : Rustogi, S KAgarwal
- (4) Organic Chemistry : O P Agarwal / Chatwal
- (5) Stereochemistry : Configuration and Mechanism : P.S.Kalsi; Wiley Eastern Ltd.
- (6) Org. Chem. 3rd Ed : James B Hendrickson, Donald J Cram, George S Hammond
- (7) Basic course in Organic Chemistry : Ramesh Luhana Rughwani : Manglam Prakashan , New Delhi

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Pattern of Question paper for semester-end Examination. Paper code CECH:508

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Question – 3 Unit – III	A –do-	5 marks
	B –do-	10 marks
Question – 4 Unit – IV	A –do-	5 marks
	B –do-	10 marks

Types of questions for section A are varied: like: one or two line answers/ definitions / reasoning/ mathematical equations/drawing small figures/ matching the answers etc.

KACHCHH UNIVERSITY : BHUJ

B.Sc. SEMESTER : V (FIVE) CHEMISTRY PAPER : IX (wef June 2016)

Paper Code NO. : CECH-509 (PHYSICAL CHEMISTRY) M. M. : 60 Examination

Time : Two Hours

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UNIT : I :

(A) Thermodynamics : (8 M)

Zeroth law of TD, Difference between heat and temperature, Thermometric equation, Trouton's law, Craft's equation, Colligative properties, Elevation in boiling point, Depression in freezing point, van't Hoff's isotherm, van't Hoff's isochore, Third law of TD, Chemical potential, Derivation of Law of mass action using Chemical potential.

(B) Chemical Kinetics : (7 M)

Activated Complex Theory, Prediction of reaction rates, Salt effect , Primary and secondary salt effects, Heterogeneous gas reaction, Retardation reaction.

UNIT : II : Electrochemistry : (15 M)

(A) Measurement of emf by Poggendorff's method, Weston cell, concentration cells, Types of concentration cells, Derivation of equation of emf of each concentration cell, Derivation of equation of emf of concentration cell with transference and without transference, LJP and derivation of equation of emf of LJP. (7 M)

(B) Application of emf measurement in determination of solubility and solubility product of sparingly soluble salt, ionic product of water, pH, thermodynamic function of G, S, H, K. Valency of cations, transference number, Instability constant of complex ion, degree of hydrolysis of a salt, Decomposition potential, its experimental determination, Application of decomposition potential, Over voltage, Types of over voltage, factors affecting over voltage, and its application. (8M)

UNIT : III

(A) Nuclear Chemistry: (10 M)

Detection of isotopes, Velocity focusing mass spectrograph, (Banbridge), Direction focusing mass spectro meter (Dempster), Double focusing mass spectrometer (Nier) , Separation of isotopes: Gaseous diffusion method, Thermal diffusion method, Mass spectrograph method, Laser technique, Applications of isotopes, Tracer technique, Artificial Nuclear reactions, Types of Nuclear reactions , Artificial and induced radioactivity, Energy changes in nuclear reactions, Nuclear Fission and nuclear fusion, Units used in nuclear science: Curie, Rutherford, Becquerel, Barn, Fermi, Gray , Sievert.

(B) Nuclear Energy : (5M)

Generation of Electricity from Nuclear Energy , Its merits and demerits, Hydrogen energy

UNIT : IV**(A) Photochemistry :****(8M)**

Laws of photochemistry, Grotthuss-Draper law, Stark-Einstein law, Quantum yield, High quantum yield , Low quantum yield, Experimental determination of quantum yield, Types of photochemical reactions, Fluorescence and Phosphorescence, Chemiluminescence Photosensitization, Flash Photolysis, Photo stationary state, Black-white and colored photography.

(B) Phase rule :**(7 M)**

Derivation of phase rule, condensed phase rule equation, study of two components systems, Pb / Ag system, Zn / Cd system, Zeotropic and azeotropic mixtures, Phenol – water , Triethylamine-water and Nicotine-water systems, Fractional distillation and steam distillation.

Pattern of Question paper for semester-end Examination. Paper code : CECH: 509

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Question – 3 Unit – III	A –do-	5 marks
	B –do-	10 marks
Question – 4 Unit – IV	A –do-	5 marks
	B –do-	10 marks

Types of questions for section A are varied: like: one or two line answers/ definitions / reasoning/mathematical equations/drawing small figures/ matching the answers etc.

PRACTICALS**KACHCHH UNIVERSITY : BHUJ****B.Sc. SEMESTER : V (FIVE) CHEMISTRY PAPER : VII (wef June 2016)****Paper Code NO. : CECH-507 P (INORGANIC CHEMISTRY): M. M. : 30****(A) Inorganic Qualitative Analysis : (24 M)**

Analysis of inorganic mixture containing six radicals only (Either 3+3 or 2 + 4 or 4+2) .
 Minimum of **10 (TEN)** mixtures to be done and reported in journal . Arsenic element not to be given in any form. No negative marking for wrong detection of Sodium ion .

Examples of some mixtures : (i) $\text{FeCl}_3 + \text{KNO}_2 + \text{NaNO}_3$ (ii) $\text{CuCl}_2 + \text{KI} + \text{CdCO}_3$

(B) Journal (3 M)**(C) Viva (3 M)****PRACTICALS****KACHCHH UNIVERSITY : BHUJ****B.Sc. SEMESTER : V (FIVE) CHEMISTRY PAPER : VIII (wef June 2016)****Paper Code NO. : CECH-508 P (ORGANIC CHEMISTRY) M. M. : 30****(A) Organic Separation and Organic spotting : (20M)**

Binary Organic Mixture : Separation of two components from the mixture . Water soluble compound included. Identification of both of the components by Lassign test, Physical & Chemical methods, determination of MP/BP and preparation of derivative of any one compound of the mixture. Minimum of SEVEN solid mixtures and three liquid mixtures to be done and reported in journal..

Chemical compounds :

Water insoluble Solids : Benzoic acid , Cinnamic acid, Salicylic acid, Phthalic acid, α -Naphthol, β -Naphthol, α - Naphthyl amine, p-Toluidine, meta and para- Nitro anilines, Diphenyl amine, m-Dinitrobenzene, Acetanilide, Naphthalene, Anthracene,

Water soluble solids : Succinic acid, Oxalic acid, Tartaric acid, Citric acid, Urea, Thiourea, Acetamide

Liquids : Low BP : Acetone, Benzene, Chloroform, Ethyl acetate, Methyl aceate , Ethanol, Methanol, CTC

High BP : Nitrobenzene, Aniline , Chloro benzene, Bromo benzene.

Few examples of Mixtures :

Solids : (1) Benzoic acid + Naphthalene (Type: Acid + Neutral), (2) Salicylic acid + α -Naphthol (Acid + Phenol) , (3) Succinic acid + m-Dinitrobenzene (Water soluble acid + insoluble neutral) etc

Liquid Mix : L + L : Benzene + Aniline , Acetone + Nitrobenzene etc

S + L : Benzoic acid + Acetone , Succinic acid + Ethyl acetate etc

(B) Organic Preparation :

(5M)

Preparation by single stage method . This exercise is for preparation of derivatives only for part (A) .

- (1) p-Bromo acetanilide from Acetanilide (Bromination)
- (2) Tri Bromo aniline from Aniline (Bromination)
- (3) Tribromo phenol from Phenol (Bromination)
- (4) p-Nitro acetanilide from Acetanilide (Nitration)
- (5) m-Dinitrobenzene from Nitrobenzene (Nitration)
- (6) Benzoic acid from Benzaldehyde (Oxidation)

(C) Viva and Journal :

(5M)

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PRACTICALS

KACHCHH UNIVERSITY : BHUJ

B.Sc. SEMESTER : V (FIVE) CHEMISTRY PAPER : IX (wef June 2016)

Paper Code NO. : CECH-509 P (PHYSICAL CHEMISTRY) M. M. : 30

(A) Physico chemical Exercise :

(24 M)

One exercise be given from the following to the candidate at the examination :

(a) Chemical Kinetics :

- (1) To study reaction between
 - (a) $K_2S_2O_8$ and KI (a = b)
 - (b) $HBrO_3$ and KI (a = b ; a \neq b)
 - (c) H_2O_2 and HI (a = b ; a \neq b)
- (2) To determine the energy of activation and temperature coefficient of hydrolysis of Methyl acetate or Ethyl acetate

(b) Conductometry :

- (1) To titrate the mix of strong acid + weak acid against strong base
- (2) To titrate the mix of strong base + weak base vs strong acid

(c) pH metry :

- (1) To titrate strong acid against strong base
- (2) To titrate a mixture of strong acid + weak acid against strong base

(d) Potentiometry :

- (1) To titrate strong acid against strong base
- (2) To titrate Fe^{+2} against $K_2C_2O_7$

(C) **JOURNAL** (3 M)

Journals are to be signed regularly by the concerned teacher and finally certified before the College Internal test. If student does not bring the certified journal at the exam, he/she will not be allowed for the exam.

(D) **Viva :** (3 M)

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KSKV Kachchh University : BHUJ

Practical Examination

B.Sc. Sem : V : Term End (University) Examination (wef June 2016)

Subject : CHEMISTRY

Duration : TWO days Time : Seven hours a day

Day 1 : (1) Inorganic Mixture (3.5 Hrs) 24 Marks + 3 M Journal + 3 M Viva

(2) Physical exercise (3.5 Hrs) 24 Marks + 3 M Journal + 3 M Viva

Day 2 : (1) Organic separation (4.0 Hrs) : 22 M + 3 Marks Journal and Viva

(2) Organic preparation (2.0 Hrs) : 5 M

(3) Journals and Viva (1.0 Hrs) For all practicals

Structure :

Day/date	Exercise	Exercise
Day 1 9.00 am to 12.30 pm	Inorganic Mixture	Organic separation
1.00 pm to 4.30 pm	Physico-Chemical exercise	Organic preparation and Viva
Day 2 9.00 am to 12.30 pm	Organic separation	Inorganic Mixture
1.00 pm to 4.30 pm	Organic preparation and Viva	Physico-Chemical exercise

Thus : 3 papers x 30 marks = 90 marks

**NB: Three separate mark sheets will be prepared one for each paper nos.
CECH: 507 P, CECH: 508 P and CECH:509 P**
