

Hemchandracharya North Gujarat University, Patan

B. Sc. Chemistry

Semester : VI

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Inorganic Chemistry

Paper : CC CH – 601

UNIT :- I : Valency

- Variation method, Secular Equation, Stability of H_2^+ ion; M.O. approach, Stability of H_2 molecule; V. B. approach, Classical interaction energy
- Representation of wave function for SP, SP^2 and SP^3 hybrid orbitals, bond angle and bond strength
- M.O. treatment of Oh molecules
- Quantum mechanical representation of Pauli's exclusion principle

UNIT :- II : Metal Carbonyl

- Introduction
- Classification: Mononuclear and Polynuclear
- Physical and Chemical Properties
- Metal Carbonyl (M-CO) bonding (On the basis of V.B.T. and M.O.T.)
- Use of IR Spectra to determination of structure of metal carbonyl
- Structure of Metal Carbonyl
 $Ni(CO)_4, Fe(CO)_5, Cr(CO)_6, Fe_2(CO)_9, Co_2(CO)_8, Mn_2(CO)_{10}, Fe_3(CO)_{12}$
- Calculation of EAN of metal atom in metal carbonyl
- Metal Nitrosyl complexes: - Bonding in metal nitrosyl
- Classification of metal Nitrosyl

UNIT :- III : Bio-Inorganic Chemistry

- Introduction,
- Essential elements,
- Trace elements
- Metal porphyrine,
- Study of hemoglobin and myoglobin
- Nitrogen fixation: In Vivo and In Vitro

Books Suggested (Inorganic Chemistry)

1. Valence and molecular structure by Cartmell and Flower.
2. Text book of Inorganic Chemistry by Durent and Durent.
3. Inorganic Chemistry by S. Chand.
4. Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand)
5. Concise Inorganic chemistry by J.D.Lee.
6. Metallic Corrosion By M.N. Desai
7. Advance Inorganic Chemistry J.E. Huhee

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Organic Chemistry

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UNIT :- I : Electrophillic and free radical addition reaction

- Addition to carbon carbon double bond
- Markovnikov's rule
- Electrophillic addition, Orientation, Reactivity, Rearrangement, Dimerization, Alkylation
- Peroxide effect (Anti markovnikov`s rule)
- Free radical addition, mechanism of peroxide initiated addition of HBr
- Syn and anti addition mechanism for addition of halogens
- Electrophillic addition to conjugated dienes (1: 2 v/s 1: 4 addition)
- Free radical addition to conjugated dienes, reactivity

UNIT :- II : Active Methylene Group Compounds

- Introduction of Tautomerism
- Determination of keto-enol tautomerism
- Differences between Tautomerism and resonance
- Synthesis and application of Ethyl aceto acetate and malonic ester

UNIT :- III : Nucleophillic Aromatic Substitutions

- Nucleophilic aromatic substitution [Bimolecular displacement (SN^2) mechanism]
- Elimination – Addition mechanism via benzyne
- Stability and properties of benzyne
- Evidences of Benzyne intermediate

Books Suggested (Organic Chemistry):

1. Organic chemistry by Morrison & Boyd V^{th} Edition
2. Advance organic chemistry by R.K.Bansal.
3. Organic chemistry by I.L.Finar Vol I &.II V^{th} Edition

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4. Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition... HJGvZ_! # YL
5. Outline of chemical technology by Dryden IInd Edition
6. Synthetic organic chemistry by Gurdeep R Chatwal.
7. Advanced organic chemistry by Jerry March.
8. Organic reactions and their mechanisms IInd edition by P.S. Kalsi.
9. Organic chemistry of natural product Vol: I & II by Gurdeep R. Chatwal.
10. Advanced organic chemistry by Arun Bahal and B.S. Bahal.
11. Organic chemistry Vol, I, II, III by S.M.Mukherjee, S.P.Singh, R.P.Kapoor.

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Physical Chemistry

Paper : CC CH – 603

UNIT:- I : Thermodynamics

- Zeroth law of thermodynamics
- Absolute temperature scale
- Nernst heat theorem
- Third law of thermodynamics
- Determination of absolute entropy
- Experimental verification of third law
- Entropy change in chemical reactions.
- Concept of Fugacity and determination of Graphical Method
- Numerical

UNIT :- II : Photochemistry

- Introduction
- Difference between Thermal and Photochemical reaction
- The Law of Absorption, Lambert-Beer law
- Laws of Photochemistry,
(1) Grotthuss-Draper law (2) Stark- Einstein law and it's deviation
- Quantum Efficiency or Quantum Yield
- Experimental determination of Quantum yield
- Reason of high and low Quantum yield
- Types of Photochemical reaction
(1) Photosensitized reaction (2) Photochemical equilibrium
- Qualitative description of fluorescence, phosphorescence and chemiluminescence.
- Flash Photolysis
- Numerical

UNIT :- III : Chemical Kinetics

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- Effect of temperature on rate of reaction (Arrhenius equation) $k = A e^{-E_a/RT}$
- Concept of Activation energy
- Theories of reaction rate
 - (1) Collision theory
 - (2) Transition state theory
- Comparison of collision and transition state theory
- Theories of Unimolecular reaction
- Lindemann's theory
- Trimolecular reaction
- Trautz's Law
- Primary salt effect
- Secondary salt effect
- Numerical

Books Suggested (Physical Chemistry) :-

1. Advance Physical Chemistry by Gurdeep Raj.
2. Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P. Rastogi and R.R.Mishra.
5. Physical chemistry by Atkins.
6. Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
7. Physical Chemistry by P.W. Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A. Alberty and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H. Barrow, 5th edn, Mac Graw Hill, 1988,6th edn, 1996.
10. Physical Chemistry by W.J.Moore, 4th edn, Orient Longmans 1969.

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Structural – Analytical Chemistry

Paper : CC CH - 604

UNIT :- I : Term symbol & spectra of d^1 - d^9 Octahedral complexes

(A)Term Symbol

- L S coupling
- J J coupling
- Determination of ground state term by hund's rules
- Determination of term symbol for all state for p^2 & d^2 configuration by pigeon hole diagram

(B)Spectra of d^1 & d^9 octahedral complexes

- Selection rules & intensities transitions
- Oral diagram for d^1 - d^9 , d^2 - d^8 , d^3 - d^7 , d^4 - d^6 octahedral & tetrahedral complexes explanation of d^1 & d^9 spectra(only introduction-no application)

UNIT :- II : IR spectra & Numericals based on UV, IR and NMR Spectra

(A) Infrared spectroscopy.

- Introduction
- Molecular vibrations (Fundamental vibrations of AX_2 type molecules)
- Characteristics of IR spectroscopy
- Sample techniques
- Fingerprint zone
- Effect of IR in geometrical isomerism
- IR spectra & H-bonding
- Factor affecting on $>C=O$ group frequencies
- Differentiate two compounds by the IR frequencies.

(B) Problems pertaining to the structure elucidation of organic compounds using UV, IR & NMR spectroscopic techniques (one out of two)

UNIT :- III : Chromatography

- Introduction
- Types of chromatography
- Column chromatography
- Paper chromatography
- Thin layer chromatography
- Ion exchange chromatography

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- Van-deemter equation
- examples
- HPLC principle
- Application of chromatography

Suggested books: (structural chemistry)

1. Chemical application of group theory by F.A.Cotton
2. Chemical bonding and introduction by K.C.Patel, R.D.Patel and Raval
3. Application of group theory to chemistry by Bhattacharya
4. Symmetry in chemistry by Jafle and Orchin
5. Advance inorganic chemistry by cotton & Wilkinson
6. Basic principles of spectroscopy by R.Chand
7. Organic chemistry Vol. 1 by S.M.Mukherji, S.P.Shingh, Kapoor
8. Spectroscopy organic compounds VIth edition by P.S.kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IVth edition by Silverstain, Bassler and Morrill.
11. Application of absorption spectroscopy of organic compounds by John R. Dyer
12. Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & Ian Fleming
13. Physical methods for chemist Ruwssell S. Drago
14. Organic spectroscopy by Williams & Kemp
15. Organic spectroscopy by V.R.Dani
16. Qualitative Analysis R.A.Day & A.L.Underwood
17. Analytical Chemistry G.D. Christain
18. Fundamentals of Analytical Chemistry D.A.Skoog, D.M. West & F.J.Holler
19. Principales of Analytical Chemistry J.H. Kennedy
20. Analytical Chemistry – Principals & Techniques L.G.Hargis

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Laboratory Course

LC CH - 607

(Inorganic, Organic, Physical Chemistry)

Inorganic Chemistry practical

Qualitative analysis (Minimum 10)

Inorganic mixture should be comprised of six radicals.

Candidate if required should be guided once for the wrong group and marks deducted for wrong group. Maximum of five marks can be deducted for wrong group.

There shall be no deduction of marks for reporting wrong radicals

Organic Chemistry practical

(A) Estimation of functional groups: (Minimum 03)

- (1) Estimation of Ester
- (2) Estimation of Amide
- (3) Estimation of Ascorbic acid
- (4) Estimation of Aspirin

(B) Synthesis of Organic Compounds (Minimum 05)

- (1) Preparation of m-Dinitro benzene from Nitrobenzene
- (2) Preparation of p-Nitro acetanilide from Acetanilide
- (3) Preparation of Acetanilide from Aniline
- (4) Preparation of Aspirine from Salicylic acid
- (5) Preparation of Di-benzal acetone from Benzaldehyde
- (6) Preparation of 2,4,6-Tribromo aniline from Aniline

[Instruments]: (Minimum 05)

1. To determine concentration of the given Iodide solution by Potentiometric titration against 0.1N KMnO_4 solution.
2. To determine formal redox potential of $\text{Fe}^{+2}/\text{Fe}^{+3}$ by Potentiometry.
3. To determine the concentration of the **nitrite** in the given solution by Colourimetric estimation method.
4. To determine the concentration of unknown solution from given $\text{K}_2\text{Cr}_2\text{O}_7$ by Colourimetry.
5. To determine the Solubility product and solubility of sparingly soluble salt of BaSO_4 by Conductometry.
6. To determine the strength of strong and weak base in a given mixture using a pH meter.

[B] Kinetics, Adsorption & Polymer (Minimum 03)

7. To study the reaction between KBrO_3 and KI at two different temperature and calculate the temperature coefficient and the energy of activation.
8. To study the absorption of Acetic Acid on Charcoal and prove the validity of freundlich equation.
9. To determination of molecular weight of high polymer (i.e. polystyrene) by Viscosity measurement.
10. To study the rate constant of the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI and study the influence of ionic strength on the rate constant

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Pattern of University Practical Exam

Time: 10:30am to 6:00pm (Including 30 minutes recess) Total Marks: 200

First Day

(A) Inorganic (50 marks)

- Inorganic Qualitative Mixture

(B) Organic (50 marks)

- Estimation (25 Marks) & Preparation (25 Marks)

Second Day

(C) Physical (50 marks)

- Any one exercise should be selected for each candidate from syllabus.

(D) Viva-Voce and Journal

• **Viva-Voce on practical base (40 marks)**

- Inorganic13 marks

- Organic13 marks

- Physical14 marks

• **Journal (10 marks)**

➤ **Note: Without Certified practical record a student will not be permitted to appear at practical examination.**