

As Per New Syllabus (CBCS Pattern and NEP 2020)

Shivaji University, Kolhapur

B.Sc. Part-III : Semester-V

INORGANIC CHEMISTRY

CHEMISTRY (DSE-E5) : PAPER-IX

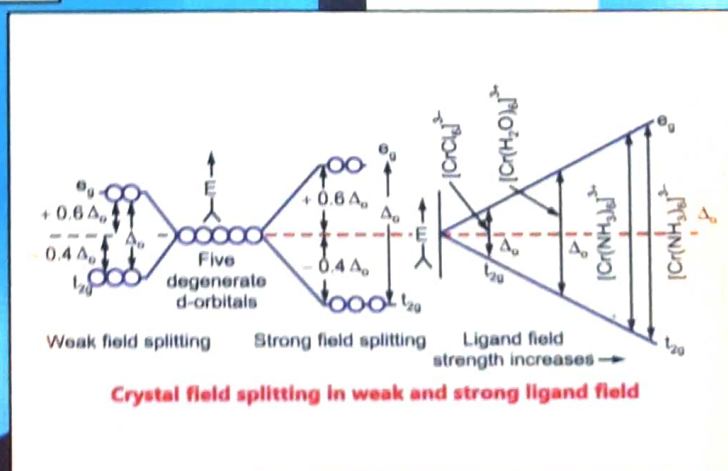
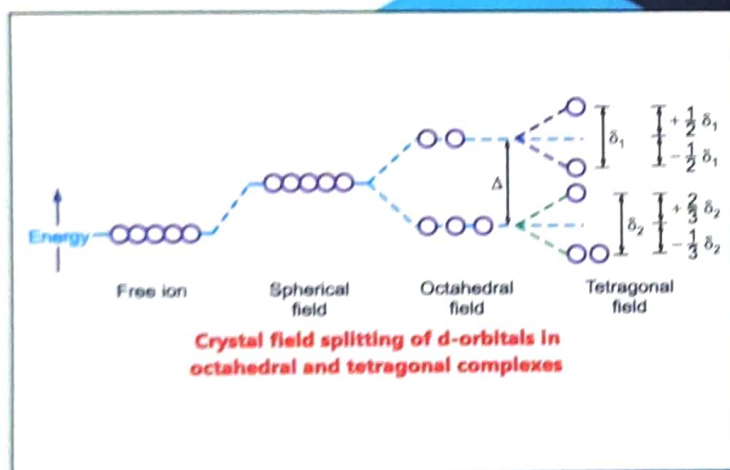
Prof. (Dr.) DNYANDEV N. ZAMBARE

Dr. AVINASH M. NALAWADE

Prof. (Dr.) REKHA A. NALAWADE

Prof. (Dr.) PRAVINA B. PISTE

Prof. (Dr.) ARJUN S. KUMBHAR



A TEXT BOOK OF

INORGANIC CHEMISTRY

(DSE-E5 : Paper-IX)
B.Sc. Part-III : Semester-V

As Per New Revised CBCS and NEP-1.0 Pattern Syllabus
of Shivaji University, Kolhapur w.e.f. June 2024

Prof. (Dr.) DNYANDEV N. ZAMBARE
M.Sc., Ph.D.

Vice Principal, Professor and Head,
P.G. Recognized Teacher, Research Guide,
Department of Chemistry,
Kisan Veer Mahavidyalaya, Wai.

Dr. AVINASH M. NALAWADE
M.Sc., M.Phil. Ph.D.

Associate Professor,
P.G. Recognized Teacher, Research Guide,
Lal Bahadur Shastri College,
Satara.

Prof. (Dr.) REKHA A. NALAWADE
M.Sc., Ph.D.

Professor, P.G. Recognized Teacher,
Research Guide,
Department of Chemistry,
Lal Bahadur Shastri College, Satara.

Prof. (Dr.) PRAVINA B. PISTE
M.Sc., M.Phil, Ph.D.

Professor and Head,
Department of Chemistry,
P.G. and Ph.D. Recognized Teacher,
Rajarshi Chhatrapati Shahu College, Kolhapur.

Prof. (Dr.) ARJUN S. KUMBHAR
M.Sc., Ph.D.

Professor, DST-SERB Young Scientist,
Department of Chemistry,
Vivekanand College, Kolhapur (Autonomous).

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Rasdharma Co-op. Hsg. Society Ltd., 'D' Wing Ground Floor, 385 S.V.P. Road
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Mob : 9850046155

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Preface

This book is basically intended for B.Sc. Part-III students for Semester V Course of Shivaji University, Kolhapur. This book is written according to new NEP-1.0 Pattern syllabus being implemented from June 2024 prescribed by Shivaji University, Kolhapur.

It is our great pleasure to present this book to the students and respected teachers in proper time. The subject matter is presented in simple and lucid language. This book covers all the chapters mentioned in the syllabus. The material is presented in a comprehensive way and the sequence of articles in each chapter helps the students to understand the subject with ease.

Different diagrams and illustrative description is provided to enhance the learning and understanding of the matter by students as well as to enable the teachers to explain the difficult concepts properly. The solved numerical examples, long answer type questions, short answer type questions including multiple type questions are given at the end of each chapter.

We are thankful to Nirali Prakashan, Pune for making us a part of their team of Authors. We thank **Mr. Dineshbhai Furia** and **Mr. Jignesh Furia** for publishing this book.

Last but not the least we are very much indebted to Mr. Virbhaval Shinde (Marketing Executive, Kolhapur District) and Mr. Ashok Nanavare (Marketing Executive, Sangli District) for their nice co-operation. We are very much thankful to Mr. Kiran Kamble (Proof Reading), Mrs. Anjali Muley (Graphic Design) and Mr. Malik Shaikh for a neat and error free D.T.P. of this book.

We hope that this book will be found useful by students and teachers. We will appreciate any suggestions for the improvement of the book.

Authors

Syllabus

Unit 1 : Acids, Bases and Non-aqueous Solvents

[06]

- 1.1 Introduction to theories of acids and bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept, Lux-Flood concept (definition and examples)
- 1.2 Hard and soft acids and bases (HSAB concept)
 - 1.2.1 Classification of acids and bases as hard, soft and border line.
 - 1.2.2 Pearson's HSAB concept.
 - 1.2.3 Acid-Base strength and hardness - softness.
 - 1.2.4 Applications and limitations of HSAB principle.
- 1.3 Chemistry of non-aqueous solvents
 - 1.3.1 Introduction, definition and characteristics of solvents
 - 1.3.2 Classification of solvents
 - 1.3.3 Physical properties and acid-base reactions in liquid ammonia (NH_3) and liquid sulphur dioxide (SO_2).

Unit 2 : Metal-Ligand Bonding in Transition Metal Complexes

[08]

- 2.1 Crystal Field Theory (CFT)
- 2.2 Introduction : Shapes of d-orbitals, Basic assumptions of CFT
 - 2.2.1 Crystal field splitting of d-orbitals of metal ion in octahedral, tetrahedral, square planar complexes and Jahn-Teller distortion.
 - 2.2.2 Factors affecting the crystal field splitting.
 - 2.2.3 High spin and low spin octahedral complexes w.r.t. Co(III).
 - 2.2.4 Crystal field stabilization energy (CFSE), Calculation with respect to octahedral complexes only.
 - 2.2.5 Limitations of CFT.
- 2.3 Molecular Orbital Theory (MOT)
 - 2.3.1 Introduction.
 - 2.3.2 MOT of octahedral complexes with sigma bonding such as $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$.
 - 2.3.3 Merits and demerits of MOT.

Unit 3 : Metals, Semiconductors and Superconductors

- 3.1 Introduction.
- 3.2 Properties of metallic solids.
- 3.3 Theories of bonding in metal
 - 3.3.1 Free electron theory.
 - 3.3.2 Molecular orbital theory (Band theory)
- 3.4 Classification of solids as conductors, insulators and semiconductors on the basis of band theory.
- 3.5 Semiconductors - Types - Intrinsic and extrinsic and applications of semiconductors.
- 3.6 Superconductors : Ceramic superconductors - Preparation and structures of mixed oxide $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$.
- 3.7 Applications of superconductors.

Unit 4 : Organometallic Compounds

- 4.1 Definition, Nomenclature of organometallic compounds.
- 4.2 Synthesis and structural study of alkyl and aryl compounds of Be and Al.
- 4.3 Mononuclear carbonyls - Nature of bonding in simple mononuclear carbonyls : $[\text{Ni}(\text{CO})_4]$, $[\text{Fe}(\text{CO})_5]$, $[\text{Cr}(\text{CO})_6]$.

Unit 5 : Catalysis

- 5.1 Introduction
- 5.2 Classification of catalytic reactions - Homogeneous and Heterogeneous
- 5.3 Types of catalysis.
- 5.4 Characteristics of catalytic reactions.
- 5.5 Mechanism of catalysis.
 - (i) Intermediate compound formation theory.
 - (ii) Adsorption theory.
- 5.6 Industrial applications of catalysis.

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2. Metal-Ligand Bonding in Transition Metal Complexes	2.1 – 2.39
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