

## Problems In Physical Chemistry Gurdeep Raj

*Written primarily to meet the requirements of students at the undergraduate level, this book aims for a self-learning approach. The fundamentals of physical chemistry have been explained with illustrations, diagrams, tables, experimental techniques and solved problems.*

*In revising the text opportunity has been taken to introduce SI units throughout. An Appendix has been included which contains tables of SI units and a table of conversion factors for use when consulting data in non-SI units. Chapter 19 now includes experiments demon strating the use of ion-exchange and solid-liquid chromatography. Exercises involving colorimetry have been included in Chapter 17. These techniques are introduced as part of a complementary exercise where their relevance is seen as part of a complete piece of work. Minor improvements have been made to some of the experimental procedures and we are grateful to those who have made helpful suggestions in this respect. G. PASS H. SUTCLIFFE iii Preface to the First Edition The student of inorganic chemistry is fortunate in having a wide choice of textbooks covering the descriptive and theoretical aspects of the sUbject. There is no comparable choice of textbooks covering practical inorganic chemistry. Moreover, there is a tendency for many students to draw an unfortunate distinction between chemistry taught in the lecture room, and laboratory work. Consideration of these points prompted the preparation of this book, in which we have attempted to emphasize the relationship between theory and practice.*

*Advanced Inorganic Chemistry - Volume II is a concise book on basic concepts of inorganic chemistry. Beginning with Coordination Chemistry, it presents a systematic treatment of all Transition and Inner-Transition chemical elements and their compounds according to the periodic table. Special topics such as Pollution and its adverse effects, chromatography, use of metal ions in biological systems, to name a few, are discussed to provide additional relevant information to the students. It primarily caters to the undergraduate courses (Pass and Honours) offered in Indian universities.*

[Mathematics for Chemists](#)

[Krishna's Environment and Ecology](#)

[Handbook of Remediation for Complex Environmental Problems](#)

[A Textbook of Inorganic Chemistry – Volume I](#)

[Advanced Inorganic Chemistry](#)

[Principles of Colloid and Surface Chemistry](#)

[Advances Practical Organic Chemistry](#)

[Advanced Inorganic Chemistry – Volume II](#)

A Textbook for B.Sc. (Part III and Hons.) and Postgraduate Courses of Indian Universities. In this edition, I have made major changes in the light of modern concepts introduced in syllabi at the under-graduate and postgraduate level as well. With matter has also been updated. The subject matter has been arranged systematically, in a lucid style and simple language. New Problems and exercises have also been introduced to acquaint the students with trend of questions they expect in the examinations.

Thermal power plants are one of the most important process industries for engineering professionals. Over the past decades, the power sector is facing a number of critical issues; however, the most fundamental challenge is meeting the growing power demand in sustainable and efficient ways. Practicing power plant engineers not only look after operation and maintenance of the plant, but,

also look after range of activities including research and development, starting from power generation to environmental aspects of power plants. The book Thermal Power Plants - Advanced Applications introduces analysis of plant performance, energy efficiency, combustion, heat transfer, renewable power generation, catalytic reduction of dissolved oxygen and environmental aspects of combustion residues. This book addresses issues related to both coal fired and steam power plants. The book is suitable for both undergraduate and research higher degree students, and of course for practicing power plant engineers.

This text teaches the principles underlying modern chemical kinetics in a clear, direct fashion, using several examples to enhance basic understanding. It features solutions to selected problems, with separate sections and appendices that cover more technical applications. Each chapter is self-contained and features an introduction that identifies its basic goals, their significance, and a general plan for their achievement. This text's important aims are to demonstrate that the basic kinetic principles are essential to the solution of modern chemical problems, and to show how the underlying question — “How do chemical reactions occur?” — leads to exciting, vibrant fields of modern research. The first aim is achieved by using relevant examples in presenting the basic material, and the second is attained by inclusion of chapters on surface processes, photochemistry, and reaction dynamics.

[Advances Practical Inorganic Chemistry \\_\\_\\_\\_\\_](#)

[Series Analytical Geometry \\_\\_\\_\\_\\_](#)

[Practical Inorganic Chemistry \\_\\_\\_\\_\\_](#)

[Krishna's Advanced Organic Chemistry: Volume 1 \\_\\_\\_\\_\\_](#)

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[Chromatography \\_\\_\\_\\_\\_](#)

[Indian Book Industry \\_\\_\\_\\_\\_](#)

[Journal of the Chemical Society of Pakistan \\_\\_\\_\\_\\_](#)

*In the recent past, there has occurred rapid revolution in spectroscopic techniques. At the same time, many new spectroscopic techniques have been introduced and also the classical spectroscopic techniques have been modified to suit the modern analytical laboratory. In this short book, all these changes have been incorporated to suit B. Sc and M. Sc. students of chemistry, physics, biochemistry, environmental science, pharmacy, engineering sciences, microbiology, biotechnology, materials science and related them more suitable for students. Line diagrams have been redrawn to make the book more il.*

*An advanced-level textbook of inorganic chemistry for the graduate (B.Sc) and postgraduate (M.Sc) students of Indian and foreign universities. This book is a part of four volume series, entitled "A Textbook of Inorganic Chemistry - Volume I, II, III, IV". CONTENTS: Chapter 1. Stereochemistry and Bonding in Main Group Compounds: VSEPR theory, dn -pn bonds, Bent rule and energetic of hybridization. Chapter 2. Metal-Ligand Equilibria in Solution: Stepwise and overall formation constants and their interactions, Trends in stepwise constants, Factors affecting stability of metal complexes with reference to the nature of metal ion and ligand, Chelate effect and its thermodynamic origin, Determination of binary formation constants by pH-metry and spectrophotometry. Chapter 3. Reaction Mechanism of Transition Metal Complexes - I: Inert and labile complexes, Mechanisms for ligand replacement reactions, Formation of complexes from aquo ions, Ligand displacement reactions in octahedral complexes- acid hydrolysis, Base hydrolysis, Racemization of tris chelate complexes, Electrophilic attack on ligands. Chapter 4. Reaction Mechanism of Transition Metal Complexes - II: Mechanism of ligand displacement reactions in square planar complexes, The trans effect, Theories of trans effect, Mechanism of electron transfer reactions - types; Outer sphere electron transfer mechanism and inner sphere electron transfer mechanism, Electron exchange. Chapter 5. Isopoly and Heteropoly Acids and Salts: Isopoly and Heteropoly acids and salts of Mo and W: structures of isopoly and heteropoly anions. Chapter 6. Crystal Structures: Structures of some binary and ternary compounds such as fluorite, antilfluorite, rutile, antirutile, cristobalite, layer lattices- CdI2, BiI3; ReO3, Mn2O3, corundum, pervoskite, limenite and Calcite. Chapter 7. Metal-Ligand Bonding: Limitation of crystal field theory, Molecular orbital theory, octahedral, tetrahedral or square planar complexes, π-bonding and molecular orbital theory. Chapter 8. Electronic Spectra of Transition Metal Complexes: Spectroscopic ground states, Correlation and spin-orbit coupling in free ions for 1st series of transition metals, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1 - d9 states), Calculation of Dq, B and β parameters, Effect of distortion on the d-orbital energy levels, Structural evidence from electronic spectrum, John-Teller effect, Spectrochemical and nephalauxetic series, Charge transfer spectra, Electronic spectra of molecular addition compounds. Chapter 9. Magantic Properties of Transition Metal Complexes: Elementary theory of magneto - chemistry, Guoy’s method for determination of magnetic susceptibility, Calculation of magnetic moments, Magnetic properties of free ions, Orbital contribution, effect of ligand-field, Application of magneto-chemistry in structure determination, Magnetic exchange coupling and spin state cross over. Chapter 10. Metal Clusters: Structure and bonding in higher boranes, Wade’s rules, Carboranes, Metal Carbonyl Clusters - Low Nuclearity Carbonyl Clusters, Total Electron Count (TEC). Chapter 11. Metal-π Complexes: Metal carbonyls, structure and bonding, Vibrational spectra of metal carbonyls for bonding and structure elucidation, Important reactions of metal carbonyls; Preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; Tertiary phosphine as ligand.*

*This book is specially designed for B.Sc. Chemistry Honours Degree students. However, it is believed to be helpful to post-graduate students also. It covers by and large physical chemistry part of the Chemistry Honours syllabus taught in different Indian Universities. Elaborate and lucid discussion of each chapter is the strength of this book. Questions and numerical problems are also included at the end of almost every chapter. Strenuous effort has been given to derive different mathematical equations as well as to handle quantum mechanics using mathematics taught in undergraduate level. The book contains 20 chapters, covering the following topics: - Thermodynamics is thoroughly discussed in this book, covering 1st law, 2nd law and 3rd law of thermodynamics, their applications, thermochemistry and its applications. Applications of thermodynamics in different areas like refrigerators, compressors, power plants, IC engines etc. are also discussed. Statistical thermodynamics is also discussed elaborately. - Chemical kinetics is another important part of chemistry since it covers reaction rate, order of a reaction, theory behind the reaction rate etc. Catalyst is also an important aspect since it has profound influence on reaction rate. Type of catalyst and mechanism of different catalyzed reactions are discussed in detail. A chemical reaction reaches an equilibrium state if carried out in a closed container. However, the equilibrium is sufficiently influenced by other parameters, like pressure, temperature etc. - Different physical states of matter (gaseous state, liquid state and solid state). In the solid state behavior of conductors and semiconductors are discussed thoroughly using quantum mechanics. - Detailed discussion of electrochemistry, electrochemical cell and ionic equilibrium is another important aspect of this book. Application of thermodynamics in electrochemical cell is also discussed. Concept of buffer solutions, pH and indicators are discussed in detail. - Phase equilibria is another important part of physical chemistry. The chapter includes details of phase rule, phase diagram, applications, different types of heterogeneous equilibrium system etc. - Colligative properties of dilute solutions are well documented, covering, Henry’s law, Raoult’s law of lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure etc. - Surface chemistry and properties of colloidal solutions are very much important in different chemical industries. These two sections are well discussed in this book. It includes details of derivation of different laws, theories behind the adsorption, stability of colloidal solutions etc. - Nuclear reactions are different from chemical reactions and energy, related to nuclear reactions is enormous, much higher than any chemical reaction. Study of different nuclear reactions including natural radioactivity, artificial radioactivity etc. and kinetics of nuclear reactions are well discussed in this book. Different areas of applications of nuclear reactions are also covered in this book. - Another important aspect of chemical reactions is chemical bonding. The book covers details of covalent bonding including quantum numbers, overlapping of atomic orbitals, molecular orbitals. Besides that ionic bonding and other types of bonding are also discussed in detail. - Photochemical reactions are different from chemical reactions. Light energy is the main source of photochemical reactions. Details of it including photochemical laws, mechanism etc. are well documented in this book.*

[Advanced Inorganic Chemistry Vol-1](#)

[International Books in Print](#)

[Synthetic Organic Chemistry: \(For Honours & Post-Graduate Students of Various Universities\)](#)

[A Textbook of Physical Chemistry](#)

[Advanced Inorganic Chemistry: Vollume II](#)

[Surface Chemistry](#)

[Advanced Physical Chemistry](#)

[Advanced Applications](#)

This book is a fruitful outcome of this feeling. Besides M. Sc. students, this book will be useful to those students who are preparing for NET (CSIR), SLET, IAS, PCS and other competitive examinations. This text includes various types of analytical techniques. Every technique included in this text is self-sufficient in itself. Every concept has been demonstrated by simple diagrams using simple mathematics and elegant style.

For more than a quarter century, Cotton and Wilkinson's Advanced Inorganic Chemistry has been the source that students and professional chemists have turned to for the background needed to understand current research literature in inorganic chemistry and aspects of organometallic chemistry. Like its predecessors, this updated Sixth Edition is organized around the periodic table of elements and provides a systematic treatment of the chemistry of all chemical elements and their compounds. It incorporates important recent developments with an emphasis on advances in the interpretation of structure, bonding, and reactivity."> From the reviews of the Fifth Edition: "The first place to go when seeking general information about the chemistry of a particular element, especially when up-to-date, authoritative information is desired."—Journal of the American Chemical Society "Every student with a serious interest in inorganic chemistry should have [this book]." —Journal of Chemical Education "A mine of information . . . an invaluable guide." —Nature "The standard by which all other inorganic chemistry books are judged." —Nouveau Journal de Chimie "A masterly overview of the chemistry of the elements." —The Times of London Higher Education Supplement "A bonanza of information on important results and developments which could otherwise easily be overlooked in the general deluge of publications." —Angewandte Chemie

The rapid pace of industrialization and its resulting by-products have affected the environment by producing hazardous wastes, which have been released into the environment. Environmental pollution is a global menace, the magnitude of which is increasing day-by-day due to urbanization, heavy industrialization, and changing lifestyles. Nanostructures as functional building blocks are an ideal candidate for investigation into the dependence of structural, optical, electrical, and magnetic properties of the quantum confinement effect and morphology, which paves the way for novel nanotechnological applications. Both physical and chemical properties of nanostructures are associated with their size, shape, and dimensionality; therefore, morphology controlled synthesis of functional nanostructures gains importance from a scientific and technological perspective.Semiconductor nanomaterials at the nanoscale are gaining significant attention in the areas of energy conversion and storage, sensing, electronics, photonics, and biomedicine. In this book, we discuss semiconducting metal oxide nanostructures like TiO2, ZnO, conducting polymers and nanocomposites for their efficient detection of harmful and toxic chemicals, and nanomaterials for photocatalytic degradation, with an emphasis on the applications of semiconducting materials for renewable energy. The book includes a brief literature survey, properties and the latest research advances in the development of various metal oxide nanostructures, and how nanocomposites and conducting polymer based nanomaterials are efficient for environmental remediation.The application of nanomaterials in the detection and removal of pathogens provides greater sensitivity, lower cost, shorter turn-around times, smaller sample sizes, in-line and real-time detection, as well as higher throughput and portability in environmental remediation. Furthermore, semiconductor photocatalysis for remediation has real potential for combating water pollution. This book provides a comprehensive look at the morphological, structural, crystalline, optical, electrical, and electrochemical properties of semiconducting metal oxides and their applications for environmental cleaning. The preparation and modification of semiconducting

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