



6th Semester

BRANCH	Subject Title	Subject Code
B.Sc. (CHEMISTRY-Major)	Bio Physical, Bio inorganic and organometallic chemistry	CHM1-161

Course Objective – By the end of the course students will be able to understand how metal ions interact with biological environments and how these interaction influences the properties of metal centers, apply principles of coordination chemistry to explain how nature tailors properties of metal centers for specific applications, answer critical questions (asked by fellow students or the instructor) and engage in scientific discussion on bioinorganic chemistry related topics The Students will become capable to design research and industrial projects to solve the problems of biological complexity and resolve various health & environmental issues. Learning objectives set the goal to create future researchers, Scientist and expertise in the field of Structural biology and Biophysics that are excellently trained and excited to work on various important medical & health problems.

Course Learning outcomes (CLO)

On completion of this course the students will be able to understand:-

- Biophysical concepts like pH, biological oxidation, bioenergetics.
- Magnetic properties and electronic spectra of transition metal complexes.
- Structure and bonding analysis of organometallic compounds using the MO theory
- Organometallic compounds of main group elements and their structure and bonding analysis
- Bio inorganic chemistry and role of metal ions in biological systems.

Content

Unit – 1

Water, pH & buffer -Water as a medium for biological reaction, concept of pH in terms of biological system, effect of pH on a biomolecule, biological buffers system. Bonding in biomolecules hydrogen bond, Vander Waal interaction ionic bond hydrophobic attraction, glycoside linkage peptide bond, phosphodiester linkage Role of different biological buffer system like -Phosphate Buffer, bicarbonate buffer protein amino acid buffer, hemoglobin buffer system

Biological oxidation- definition types of biological oxidation reduction) oxidation by direct action of oxygen. oxidation by loss of hydrogen Electron transport chain, inhibitors of ETC

Oxidative phosphorylation definition, theories inhibitors of oxidative phosphorylation ,Un- couplers

Bioenergetics - couple reactions, Law of thermodynamics.

Energy, relationship between, standard free energy change and equilibrium constant, general introduction of high energy compounds Structure of ATP as universal currency of free energy in biological systems with example-in muscle contraction, free energy of ATP hydrolysis.



Unit – 2

Magnetic properties of transition metal complex

Introduction, types of magnetic behaviour: diamagnetism, paramagnetic, ferro magnetism, antiferromagnetism, ferrimagnetism, origin and calculation of magnetism. methods of determining magnetic susceptibility, Bhatnagar Mathur. Quincke's Curie and nuclear Magnetic resonance method, magnetic moment, LS coupling, determination of ground state terms symbol, orbital contribution to magnetic moments and application of magnetic moment data for 3D metal complexes

Unit - 3

An Introduction to Organometallic Compounds-Definition and Classification with appropriate examples based on nature of metal-carbon bond (tonic, sp and multicentre bonds).

Metal Alkyls Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of inubicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler Natta Catalyst).

Organomagnesium compounds- Grignard reagent. preparations, structure and Chemical reactions

Organozinc compounds-Preparations and chemical reactions.

Organolithium compounds- Preparations and chemical reactions.

Organosulphur compounds.Nomenclature. structural characteristics. Thiol. thio-ether, sulphonic acid, sulphonamide and sulphaguanidine-methods of preparations and chemical reactions.

Unit – 4

Metal Carbonyls-18 electron rule, electron count of mononuclear, polynuclear 12 and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π - acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Unit – 5

Bioinorganic Chemistry - Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity. Use of chelating agents in medicine. Iron and its application in bio-systems. Role of Mg ions in energy production and chlorophyll. Role of Ca in blood clotting Hemoglobin; Storage and transfer of iron.



Practical's

1.Synthesis

1. To synthesize Ferrocene from FeCh
2. To Synthesize $K[Fe(CO)]$ Complex
3. synthesize of CiCilly)
4. Synthesis of Aceto-Fe Complex
- 5.Synthesis of triphenyl methanol from benzoic acid

2.Instrumentation

1. Determination of ph of the Bio sample
2. To determine the Sugar in Blood sample by Photometry Method
3. Determination of the Na. Kions in water sample by flame photometry

3.Chromatography

1. Determination of Revalues of Fe/Co/Pb/Ag+ by column Chromatography
2. Determination of Rr Values of Pb/CuHg₂ by TLC

4.Polarography

1. To determine EMF of Fe and Co ions in Bio sample
- 2 To determine EMF of Pb, Cd and Hgions by Polarography method