2020-21

Multani Mal Modi College, Patiala

Unit Planning MSc Chemistry - I

Department of Chemistry

Multani Mal Modi College, Patiala

Unit Plan

CHM-101

Class:- MSc Chemistry 1(Sem:- First)

Subject:- Inorganic Chemistry

Subject Teacher:-Dr Gaganpreet Kaur Session :- 2020-21

S.No.	Syllabus/Topic	Reference	Mode of Transactions	Additional Resources
		November 2020		
1	The ionic bond, covalent bond, the variation method, ground state energy of hydrogen atom, the secular equations, the molecular orbital theory	Advanced Inorganic Chemistry - Cotton & Wilkinson (3rd, 4th & 5th Ed.)	Lecture, Discussion	----------
		December 2020		
1	**Pi Bonding Ligand Complexes:** Pi Acid Ligands: CO as prototype, other pi acid ligands- isocyanide ligands, dinitrogen, the CS ligands, the NO ligands, pi acid ligands : trivalent phosphorus compound, multiple bonds from ligands to metal, pi complexes of unsaturated organic molecules : alkene & alkyne, enyl ligands, aromatic ring systems. Theories of	Inorganic Chemistry - Shriver, Atkins & Lang Ford. Inorganic Chemistry of Biological Processes - Hughes.Inorganic chemistry- Puri Sharma Kalia	Lecture, Discussion	Reading Material 1 Reading Material 2

	Bonding in Transition Metal complexes – Qualitative Approach : Qualitative introduction to the molecular orbital theory, complexes with no pi bonding, complexes with pi-bonding, the crystal field & ligand field theories, orbital splitting and magnetic properties, the angular overlap model.			
2	**Structural and Thermodynamic Consequences of Partly Filled- shells:** Ionic radii, Jahn-Teller effects, thermodynamic effects of d-orbital splitting, magnetic properties of chemical compounds, origin of magnetic behavior, magnetic susceptibility and types of magnetic behavior : diamagnetism, paramagnetism, ferromagnetism : types of paramagnetic behavior : Large multiplet separation, small multiplet separations, spin only, heavy atoms, high spin-low spin cross overs.	Inorganic Chemistry - Shriver, Atkins & Lang Ford. Inorganic Chemistry of Biological Processes - Hughes.Inorganic chemistry- Puri Sharma Kalia	Lecture, Discussion	Video Lecture by prof. D.Ray, IIT Kharagpur
		January, 2020		
1	**Spectral Properties:**	Inorganic Chemistry - Shriver,	Lecture, Discussion	----------

	Russel - Saunder's term, selection rules, break down of selection rules, band widths & shapes, energy level diagrams and d-d complex spectra, Orgel diagrams - weak fields, charge - transfer spectra, photochemical reactions of chromium & ruthenium complexes.	Atkins & Lang Ford. Inorganic Chemistry of Biological Processes - Hughes.Inorganic chemistry- Puri Sharma Kalia		
2	**Bioinorganic Chemistry:** Introduction, the biochemistry of Iron : iron storage and transport ferritin, transferrin, bacterial iron transport, hemoglobin and myoglobin, nature of the heme-dioxygen binding, model systems, cooperativity in hemoglobin cytochromes, other iron - porphyrin bimolecule peroxidases & catalases, cytochrome P450 enzymes, other natural oxygen carriers - hemerythrins, iron - sulfur proteins. The biochemistry of other metals : zinc (carboxypetidase A, carbonic anhydrase, metallothioneins), copper (superoxide dismutase (CuZn SOD), hemocyanins,	Inorganic Chemistry of Biological Processes - Hughes.Inorganic chemistry- Puri Sharma Kalia	Lecture, Discussion	----------

	oxidases), cobalt (cyanocobalamin), molybdenum (nitrogenases) & tungsten.			
February, 2020				
1	Miscellaneous other elements : vanadium, chromium & nickel metal ions, chelates in chemotherapy, synthetic metal chelates as antimicrobial agents, lithium and mental health, gold and its compounds, metal complexes as antitumour agents, chelation therapy.	Bio-Inorganic Chemistry - R.W. Hay (John Wiley & Sons). Inorganic Chemistry-Shriver, Atkins & Langford. Inorganic chemistry- Puri Sharma Kalia	Lecture, Hand written notes, Seminar	----------

Multani Mal Modi College, Patiala

Unit Plan

CHM-102

Class:- MSc Chemistry 1(Sem:- First)

Subject:- Organic Chemistry

Subject Teacher:-Dr Harjinder Singh **Session :- 2020-21**

S.No.	Syllabus/Topics	Reference	Mode of Transactions	Additional Resources*
	November, 2020			
1	Carbocations : Generation, Structure, Stability, Application of NMR spectroscopy in the detection of Carbocation	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications	Lecture,	----------
	December, 2020			
1.	Allylic and benzyllic carbocations. Stereochemistry and reactions. Nonclassical carbocations : Phenonium ion, norbornyl system, explaination based on rearrangement.Carbanions : Generation, Structure, stability, stereochemistry, Tautomerism, Prototropy and general reactions.	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications *Organic Chemistry*, R.T. Morrison and R.N. Boyd, Prentice-Hall.	Lecture	----------

2.	Carbenes : Formation, Structure, Singlet & Triplet carbene, Stereochemsitry and reactions. Nitrenes : Formation, Structure Singlet & Triplet nitrene, Stereochemsitry and reactions. Arynes : Formation, Structure and reactions. Free radicals : Formation, Structure, Stability, Stereo-chemistry and reactions	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications *Organic Chemistry*, R.T. Morrison and R.N. Boyd, Prentice-Hal	Lecture	Youtubevideo
3.	Reaction of Free Radicals Polymerisation, Halogenation Chlorination, bromination, Bromination by NBS, Iodination, Fluorination, Polar effects in halogenation. Addition Reactions : Free radical addition of HBr, Hcl, HI thiols and halogens. Auto-oxidation Rearrangements	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications *Organic Chemistry*, R.T. Morrison and R.N. Boyd, Prentice-Hall.	Lecture	----------
January, 2020				
1.	Introduction to fullernes Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's Rule, anti-aromaticity,	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati	Lecture	----------

	homo-aromaticity, PMO - approach. Bonding weaker than Covalent : Addition compounds, Crown ether complexes and Cryptands, inclusion compounds, Cyclodextrins, Catenanes and rotaxane.	Publications *Organic Chemistry*, R.T. Morrison and R.N. Boyd, Prentice-Hall. *Advanced Organic Chemsitry - Reaction, Mechanism and Structure*, Jerry March, Johny Wiley.		
2.	Use of optical, Stereochemical and isotopic techniques. Reaction studies from identification of products. Trapping of intermediate, crossover experiments, use of Catalyst, use of isotopes in reaction mechanism studies in case of Favorskii, Claisen's and Benzyne reactions.	*Advanced Organic Chemsitry - Reaction, Mechanism and Structure*, Jerry March, Johny Wiley.	Lecture	
3.	E2, E1 and E1 CB mechanism, Stereochemistry Product ratio, Orientation of double bond, Hofman Rule, Saytzeff Rule. Factors Governing E2 & E1 Mechanism.	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications	Lecture	
February 2020				
1.	Cyclic Elimination : Amine Oxide, Esters, Xanthate, and Free radical	Advanced Organic Chemistry	Lecture	Video Lecture

	elimination. Dehalogenation by zinc. Triple bond by elimination. Elimination versus substitution. Effect of solvent, temperature, Nature of Base, Structure of the reactants. Aromatic Elimination : Benzyne, Nucleophillic aromatic substitution, addition elimination.	Jagdamba Singh, L.D.S Yadav, A Pragati Publications *Organic Chemistry,* R.T. Morrison and R.N. Boyd, Prentice-Hall. *Advanced Organic Chemsitry - Reaction, Mechanism and Structure,* Jerry March, Johny Wiley.		
2.	Molecular Orbital symmetry, Frontier Orbitals of ethylene, 1,3 - butadiene, 1, 3, 5- hexatrience and allylsystem. Classification of Pericyclic reactions. Woodward-Hoffman rule, correlation diagrams. FMO and PMO approach. Electrocyclic reactions - conrotatory and disrotatorymotions 4n, 4n+2 and allylsystems. Cycloadditions - antarafacial and suprafacial additions 4S+2S Systems and 2S+2S additions of alkene. Sigmatropic rearrangement - suprafacial and	Advanced Organic Chemistry Jagdamba Singh, L.D.S Yadav, A Pragati Publications Pericyclic Reactions, S.M. Mukherji, Macmillan, India.	Lecture	Video Lecture

	antarafacial shift involving carbon moieties. 3, 3-and 5, 5-sigmatropic rearrangement Claisen, Cope-rearrangement reactions.			

*Demonstration/case study/suggested reading links/images/animations/pdf/ppt etc

Multani Mal Modi College, Patiala

Unit Plan

CHM-103

Class:- MSc Chemistry 1(Sem:- First)

Subject:- Physical Chemistry

Subject Teacher:-Ms. Priyanka Khanna **Session :- 2020-21**

S.No.	Syllabus/Topics	Reference	Mode of Transactions	Additional Resources*
		November 2020		
1	Recall: Concepts involved in first and second law of thermodynamics, Entropy, free energy and chemical equilibrium. Thermodynamic equation of state. Maxwell relations.	1. Pardeep publication of B.Sc II. ; **chapter-1** 2. Puri Sharma Pathania**.**	Lecture, Discussion	--------
		December 2020		
1	Third law of the thermodynamics: Indentification of statistical and thermodynamic	Puri, Sharma Pathania.	Lecture, Seminar	

	entropy. Nernst postulate, Plank's contribution. Alternate formulation of third law. Cooling by adiabatic and demagnetisation. Evaluation of absolute entropy.			
2	Non-ideal systems : Excess functions for non-ideal systems. Activity and activity coefficients and their determination. Concept of fugacity and its experimental determination. Partial molal properties and their determination.	Puri Sharma Pathania.	Lecture, Discussion,	
3.	**Thermodynamic and living systems** : Simultaneous or coupled reactions. Coupled reactions and metabolism. Free energy utilisation in metabolism. Terminal oxidation chain. Overall metabolic plan. General thermodynamic consideration of living systms.	Puri Sharma Pathania.	Seminar ,video	**webpage** **video**
		January 2020		
1	Statistical Thermodynamics (i)General introduction : Phase space, microstates, macrostates, thermodynamic probability. Brief introduction to	Puri Sharma Pathania	Lecture	

	different types of statistics. Ensemble concept. Canonical, grand canonical and microcanocical ensembles. Stirling approxination, Maxwell Baltzmann distribution law. (ii) Partition function and thermodynamic properties : Partition function and its factorization. Translational, rotational, vibrational; electronic and nuclear partition functions. Expressions for internal energy, entropy, Helmholtz function, Gibb's function, pressure, work and heat in terms of partition function. Thermodynamic properties of ideal gases. Vibrational, rotational, electronic and nuclear contributions to the thermodynamic properties.			
2	**Electrochemistry** (i) Ion-solvent interactions : Born model of ion-solvent interactions, Structural models of ion - solvent interations. Experimental determination of salt-solvent interactions. Relative heats of solvation of ions in the hydrogen scale. Evaluation of ion-solvent interactions from experimental data of salt-solvent	Puri Sharma Pathania Bockris and Reddy, Modern Electrochemistry, Vol. I Glasstone, Electrochemistry	Lecture, Seminar	

	interactions.			
February 2020				
1	Electrical Double layer : Electrokinetic phenomenon. Null point and its determination. Structure of electrical double layer, parallel plate condenser theory, diffuse layer theory and adsorption theory of double layer. Electrocatalysis : A chemical catalyst and an electrochemical catalyst, Electrocatalysis in redox reactions. Electrocatalysis in reactions involving adsorbed species. Some specific feature of electrocatalysis. Electrochemical Energy Conversion and Electricity storage : Direct energy convertors. Efficiency of electrochmical energy convertors. Some typical examples of electrochemical energy convertors. Advantages and applications of fuel cells. Electricity storage density and energy density. Various electricity storers and their applications. Corrosion of Metals : Classification of corrosion	Puri Sharma Pathania Bockris and Reddy, Modern Electrochemistry, Vol. I Glasstone, Electrochemistry	Lecture, Discussion,	

	processes, theories of corrosion processes, passivation of metals. Corrosion monitoring and methods of corrosion prevention			

MULTANI MAL MODI COLLEGE, PATIALA

UNIT PLAN

Class – M.Sc. Ist year (Chemistry)

(Semester I)

Subject : Biology for Chemists Subject Code: 104 (B)

Subject Teacher : Dr. Bhanvi Wadhawan Session : 2020-21

S.No.	Syllabus/Topics	Reference	Mode of Transactions	Additional Resources*
	November 2020			
1	**Origin of Life :** Unique properties of Carbon, Chemical evolution and rise of living systems. Introduction of biomolecules, building blocks of biomolecules.	*Biology for Chemists*, P.K.Aggarwal Ashok Sabharwal & S. K. Malhotra: *Modern Zoology*, Vol. II, Modern Publishers	Lecture	https://www.pbs.org/video/montanapbs-presents-search-origin-life/
	December 2020			
2	**Cell Structure, Functions and divisions** Structure of prokaryotic .& eukaryotic cells, Intracellular organelles and their functions, Comparison of plant and	De Robertis, EDP, Dc Robertis, E.M.F., *Cell Biology and*	Lecture	Cell cycle and Mitosis presentation Meiosis presentation

	animal cells. Overview of metabolic process - catabolism and Anabolism. ATP - the Biological energy currency. Cell division stages of mitosis & meiosis. Significance of cell division and fertilization.	*Molecular Biology*, Eighth Edition. W.B. Saunders Co., Philadelphia, 1995. Powar, C.B., *Cell Biology*, Himalaya Publishing House, Bombay, 1999.		Cell structure and function presentation
3	**Carbohydrates** Monosaccharides, structure & functions of important derivatives of monosaccharides(Enantiomers, Epimers, Hemiacetal, Hemiketalepanomers). O-glycosidic bond disaccharide & Polysaccharides. Structural polysaccharides. Reducing and non-reducing sugars. Structural Polysaccharides - cellulose and chitin. Storage Polysaccharides - starch and glycogen. Structure and Biological functions. Carbohydrate metabolism - Kreb's Cycle, glycolysis, glycogenesis and glycogenolysis, gluconeogenesis, Pentose phosphate Pathway.	*Principles of Biochemistry*, A.L. Lehninger, Worth Publishers. *Biochemistry*, L. Stryer, W.H. Freeman.	Lecture	Open source book article on Carbohydrate structure
January 2020				

4	**Lipids** Fatty acids, essential fatty acids, structure and function. Storage lipids. Triacyl glycerols. Structural lipids- phospholipids, Glycolopids & Archaebacterial ether lipids. Lipoproteins — composition and function. Lipids as Signals, Co factors and pigments, Lipid and cell membrane. Properties of lipid aggregates — micelles, bilayers, liposomes and their possible biological functions, Biological membranes and transport.. Fluid mosaic model of membrane structure. Lipid metabolism - beta - oxidation of fatty acids.	*Principles of Biochemistry*, A.L. Lehninger, Worth Publishers. Biochemistry, L. Stryer, W.H. Freeman.	Lecture	
5	**Structure of Proteins** Amino acids, essential and non essential, Iminoacids their structure, properties and classification, Ionic properties of amino acids. pka and zwitterion form, Peptide bond chemical properties of amino acids. Primary structure - peptide chain. Secondary structure of proteins, forces responsible for holiding of secondary structure - α halix, beta sheets, Tilius & loops, triple helix structure of collagen. Tertiary structure of protein. Quarternary structure of	*Principles of Biochemistry*, A.L. Lehninger, Worth Publishers. Biochemistry, L. Stryer, W.H. Freeman.	Lecture	

	homoglobin. Degradation and biosynthesis of amino acids, sequence determination : chemical/ enzymatic/mass spectral, racemization/detection.			
6	**Enzymes** Enzymes as biological catalyst and mode of their action.	Ashok Sabharwal & S. K. Malhotra: *Modern Zoology*, Vol. II, Modern Publishers	Lecture	Open source article on Enzymes
February 2020				
7	**Structure of Nucleic Acids** Purines and Pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonuclic acids (RNA) and deoxyribonucleic acids (DNA), Types of DNA and RNA, double helix model of DNA and forces responsible for holding' it Chemical and enzymatic hydrolysis of Nucleic acids.	*Principles of Biochemistry*, A.L. Lehninger, Worth Publishers.	Lecture	
8	**Replication of DNA** The chemical basis of heredity and overview of replication of DNA.	*Biology for Chemists*, P.K.Aggarwal	Lecture	https://www.biointeractive.org/classroom-resources/dna-replication-basic-detail
9	**Protein synthesis & Genetic Code** Transcription, translation and genetic code,	*Biology for Chemists*, P.K.Aggarwal	Lecture	https://www.genome.gov/genetics-glossary/Genetic-Code

	chemical synthesis of mono and trinucleoside.				