

# GOVERNMENT COLLEGE FOR WOMEN, ATELI

## Lesson Plan (From July 2023 to December 2023)

**Neelam Bharti**

**B.Sc. 1<sup>st</sup> Sem.**

**Assistant Professor of Chemistry**

### **Week 1, 24 July to 29 July**

**Atomic Structure** : Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals

### **Week 2, 1 Aug- 5 Aug.**

**Gaseous States** : Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path.

### **Week 3, 7Aug- 12Aug.**

Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behaviour of real gases using Vander Waal's equation

### **Week 4, 14 Aug- 19Aug.**

**Structure and Bonding** :Localized and delocalized chemical bond, van der Waals interactions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

Unit Test

### **Week 5, 21Aug- 26Aug.**

**Periodic Properties** :General principles of periodic table: Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge, Slater's rules.

### **Week 6, 28Aug- 2 Sept.**

Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table (in s & p block elements)

### **Week 7, 4 Sept- 9 Sept.**

**Critical Phenomenon:** Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants. Critical compressibility factor. The Law of corresponding states. Liquefaction of gases.

### **Week 8, 11 Sept- 16Sept.**

**Stereochemistry of Organic Compounds-I :** Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

### **Week 9, 18 Sept- 23 Sept.**

**Covalent Bond :** Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (  $\text{BeF}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{SO}_4^{2-}$ ,  $\text{ClO}_4^-$  ) Valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2^-$  and  $\text{H}_2\text{O}$ . MO theory of hetero nuclear (CO and NO) diatomic molecules, , bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference

### **Week 10, 25 Sept- 30 Sept.**

**Liquid States :** Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

### **Week 11, 3 Oct.-7 Oct.**

**Stereochemistry of Organic Compounds-II:** Relative and absolute configuration, sequence rules, R & S systems of nomenclature. Geometric isomerism determination of configuration of geometric isomers. E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, Newman projection and Sawhorse formulae, Difference between configuration and conformation

Unit Test

### **Week 12, 9 Oct.-14 Oct.**

**Ionic Solids :** Ionic structures ( $\text{NaCl}$ ,  $\text{CsCl}$ ,  $\text{ZnS}$ (Zinc Blende),  $\text{CaF}_2$ ) radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice

energy (mathematical derivation excluded) and Born-Haber cycle, solvation energy and its relation with solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule

### **Week 13, 16 Oct.-21 Oct.**

**Solid State:** Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements of crystals. Definition of unit cell & space lattice. Bravais lattices, crystal system.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl. Liquid crystals: Difference between solids, liquids and liquid crystals, types of liquid crystals. Applications of liquid crystals.

### **Week 14, 23 Oct.-28 Oct..**

**Mechanism of Organic Reactions :** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species

Unit Test

### **Week 15, 30 Oct.-6 Nov.**

**Alkanes and Cycloalkanes :** IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties.

### **Week 16, 7 Nov.- 20 Nov,**

Synthesis of cycloalkanes and their derivatives – photochemical (2+2) cyclo addition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations., theory of strainless ring

**Unit wise Revision**

**Neelam Bharti**  
**Deptt. Of Chemistry**

# GOVERNMENT COLLEGE FOR WOMEN, ATELI

Lesson Plan (From January, 2024 to June 2024)

NAME: NEELAM BHARTI

CLASS: B. Sc.II Sem

Subject: Chemistry (Physical, Organic and Inorganic Chemistry)

Dates/Weeks	Contents
Week 1	Kinetics I
Week 2	Kinetics II
Week 3	Electrochemistry I
Week 4	Electrochemistry II
Week 5	Alkanes
Week 6	Arenes and aromaticity
Week 7	Dienes and alkynes
Week 8	Alkyl and arylhalides
Week 9	H- bonding and Vander Walls forces, Metallic bond and Semiconductors
Week 10	s-block elements and Noble gases
Week 11	p- block elements; Boron and Carbon family
Week 12	Nitrogen family, Oxygen family
Week 13	Halogen family
Week 14	Revision

**Neelam Bharti**

Assistant Professor of Chemistry

Govt. College for Women, Ateli



# GOVERNMENT COLLEGE FOR WOMEN, ATELI

## Lesson Plan (From July 2023 to December 2023)

**Neelam Bharti**  
**Assistant Professor of Chemistry**

**B.Sc. 3<sup>rd</sup> Sem.**

### **Week 1**\_\_\_\_\_

**Alcohols:** Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

### **Week 2**\_\_\_\_\_

Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [ $\text{Pb}(\text{OAc})_4$  and  $\text{HIO}_4$  ] and pinacol-pinacolone rearrangement.

### **Week 3**\_\_\_\_\_

**Chemistry of Elements of 1st transition series:** Definition of transition elements, position in the periodic table, General characteristics & properties of 1st transition elements,. Structures & properties of some compounds of transition elements –  $\text{TiO}_2$ ,  $\text{VOCl}_2$  ,  $\text{FeCl}_3$  ,  $\text{CuCl}_2$  and  $\text{Ni}(\text{CO})_4$

### **Week 4**\_\_\_\_\_

**Thermodynamics-I:** Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy.

### **Week 5**\_\_\_\_\_

Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient for ideal gas and real gas: and inversion temperature.

## Unit test

### Week 6\_\_\_\_\_

**Epoxides** : Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides

### Week 7\_\_\_\_\_

**Chemistry of Elements of IInd & IIIrd transition series:** General characteristics and properties of the IInd and IIIrd transition elements Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii

### Week 8\_\_\_\_\_

**Thermodynamics-II** : Calculation of w.q.  $dU$  &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoff's equation. Bond energies and applications of bond energies.ii, oxidation state, magnetic and Spectral properties and stereochemistry

### Week 9\_\_\_\_\_

**Phenols** : Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

### Week 10\_\_\_\_\_

**Coordination Compounds** : Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

### Week 11\_\_\_\_\_

**Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore,



Van't Hoff reaction isotherm. Le-Chatetier's principle and its applications  
Clapeyron equation and Clausius – Clapeyron equation its applications.

## Unit Test

### Week 12\_\_\_\_\_

**Ultraviolet (UV) absorption spectroscopy:** Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones, Woodward- Fieser rules, calculation of max of simple conjugated dienes and  $\alpha,\beta$ -unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple organic compounds.

### Week 13\_\_\_\_\_

**Non-aqueous Solvents:** Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$

### Week 14\_\_\_\_\_

**Distribution Law:** Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride. (ii) Determination of equilibrium constant of potassium tri-iodide complex and process of extraction.

## Unit Test

### Week 15\_\_\_\_\_

**Carboxylic Acids & Acid Derivatives:** Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation.

### Week 16\_\_\_\_\_

Structure , nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic).

### **Unit wise Revision**

**Neelam Bharti**  
**Dept. of Chemistry**  
**GCW, Ateli**

# GOVERNMENT COLLEGE FOR WOMEN, ATELI

Lesson Plan (From January, 2024 to June 2024)

NAME: NEELAM BHARTI

CLASS: B. Sc. IV Sem

Subject: Chemistry (Physical, Organic and Inorganic Chemistry)

Dates/Weeks	Contents
Week 1	Thermodynamics III
Week 2	Thermodynamics IV
Week 3	Electrochemistry III
Week 4	Electrochemistry IV
Week 5	Infra-red absorption spectroscopy
Week 6	Amines
Week 7	Diazonium salts and Nitro compounds
Week 8	Aldehydes
Week 9	Ketons
Week 10	Chemistry of f-block elements Lanthanides
Week 11	Chemistry of f-block elements Actinides
Week 12	Theory of qualitative and quantitative inorganic analysis I
Week 13	Theory of qualitative and quantitative inorganic analysis II
Week 14	Revision

**Neelam Bharti**

Assistant Professor of Chemistry

Govt. College for Women, Ateli

# GOVERNMENT COLLEGE FOR WOMEN, ATELI

## Lesson Plan (From July 2023 to December 2023)

**Neelam Bharti**

**B.Sc. V Sem.**

**Assistant Professor of Chemistry**

### **Week 1** \_\_\_\_\_

**Carbohydrates-I** : Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

### **Week 2** \_\_\_\_\_

**Carbohydrates-II**: An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

### **Week 3** \_\_\_\_\_

**Metal-ligand Bonding in Transition Metal Complexes** : Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters

### **Week 4** \_\_\_\_\_

**Spectroscopy-I**: Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-Oppenheimer approximation, Degrees of freedom. Rotational Spectrum Diatomic molecules.

### **Week 5** \_\_\_\_\_

Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann

distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect

## Unit Test

### Week 6 \_\_\_\_\_

**Magnetic Properties of Transition Metal Complexes** : Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of  $s$  and  $eff$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

### Week 7 \_\_\_\_\_

**Electron Spectra of Transition Metal Complexes** : Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of  $[Ti(H_2O)_6]^{3+}$  complex ion

### Week 8 \_\_\_\_\_

**Spectroscopy-II Vibrational spectrum Infrared spectrum**: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of an harmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

### Week 9 \_\_\_\_\_

**Raman Spectrum**: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectra

## Unit Test

### Week 10 \_\_\_\_\_

**Organometallic Compounds** : Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds:

formation and chemical reactions. Organolithium compounds: formation and chemical reactions

**Week 11** \_\_\_\_\_

**NMR Spectroscopy-I** : Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons.

**Week 12** \_\_\_\_\_

**Thermodynamic and Kinetic Aspects of Metal Complexes:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt(II)

**Week 13** \_\_\_\_\_

**Quantum Mechanics-I:** Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics , quantum mechanical operator, commutation relations,

**Week 14** \_\_\_\_\_

Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

**Unit Test**

**Week 15** \_\_\_\_\_

**NMR Spectroscopy-II** : Discuss ion of PMR spectra of the molecules: ethyl bromide, npropyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds

**Week 16 \_\_\_\_\_**

**Physical Properties and Molecular Structure** : Optics activity, polarization – (Clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism

**Revision Unitwise**

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**GCW, Ateli**

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Lesson Plan (From January, 2024 to June 2024)

NAME: NEELAM BHARTI

CLASS: B. Sc.VI Sem

Subject: Chemistry (Physical, Organic and Inorganic Chemistry)

Dates/Weeks	Contents
Week 1	Electronic Spectrum
Week 2	Photo Chemistry
Week 3	Solutions and Colligative properties
Week 4	Phase Equilibrium
Week 5	Hetero cyclic compounds-I
Week 6	Hetero cyclic compounds-II
Week 7	Organosulphur compounds
Week 8	Synthetic polymers
Week 9	Amino Acids, Peptides and Proteins
Week 10	Organometallic Chemistry
Week 11	Acids and bases HSAB concept
Week 12	Bioinorganic Chemistry
Week 13	Silicones and Phosphazenes
Week 14	Revision

**Neelam Bharti**

Assistant Professor of Chemistry

Govt. College for Women, Ateli