

Government College for Women, Rohtak  
Lesson plan, Odd Semester Session  
2021-2022

Department of Chemistry  
Name of extension lecturer: **Sangita**  
B.Sc. 1 (Physics Hons.) 1<sup>st</sup> semester

**October 2021**

- Third Week – Bonding: Qualitative approach to valence bond theory and its limitations. Hybridization
- Fourth Week – Equivalent and non-equivalent orbitals, Bent's rule and applications. Molecular orbital theory

**November 2021**

- First Week – Diwali Vacations
- Second Week – Molecular orbital diagram of diatomic and polyatomic systems. Organisation of solids: Packing of ions in crystals, close packed structures, spinels
- Third Week -- ilmenite and perovskite structures of mixed metal oxides. Size effects, radius ratio rules and their limitations.
- Fourth Week -- Lattice energy, Born equation, Madelung constant, Kapustinskii equation and its applications, Born Haber cycle and its application.
- Fifth week -- Solvation energy, Packing of atoms in metals, qualitative idea of valence bond and band theories, semiconductors and insulators.
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**December 2021**

- First week -- Defects in solids, conductance in ion solids. Introduction to superconductors.
- Second week-- Weak chemical forces: Vander wall forces, Hydrogen Bonding, Effects chemical forces on m.p., b.p. and solubility, energetic of dissolution process.
- Third week-- Crystal field theory- measurement of  $10 Dq$  CFSE in weak and strong fields, Pairing energies, factors affecting the magnitude of  $10 Dq$ .
- Fourth Week – Octahedral vs. Tetrahedral coordination, tetragonal distortions from octahedral symmetry
- Fifth week-- The Jahn-teller theorem, square-planar coordination ligand field and molecular orbitals theories.

## **January 2022**

First week-- The trans effect. Mechanism of trans effect, Kinetic of square planer-substitution reaction, Thermodynamic and kinetic stability

Second week--- Kinetics of octahedral substitution reaction, Mechanism of substitution in octahedral complexes

Third week—Mechanism of electron transfer reaction ( inner and outer sphere Mechanism)

Fourth Week-- Revision and class tests.

Government PG College for Women, Rohtak  
Lesson plan, Odd Semester Session  
2021-2022

Department of Chemistry  
**INORGANIC CHEMISTRY**

B.Sc. II (Medical and Non Medical) 3rd semester (Sections A, B, C and D)

October, 2021

- First Week – Definition of transition elements  
Second Week – position in the periodic table  
Third Week – General characteristics and properties of d-block elements  
Fourth Week – Comparison of properties of 3d elements with 4d and 5d elements in reference to atomic radii.

November, 2021

- First Week – Oxidation state  
Second Week – magnetic properties of transition elements  
Third Week -- Spectral properties and stereochemistry of d-block elements  
Fourth Week -- Structures and properties of some compounds of transition elements –  
TiO<sub>2</sub>, VOCl<sub>2</sub>,

December, 2021

- First Week – Structures and properties of some compounds of transition elements  
FeCl<sub>3</sub>, CuCl<sub>2</sub> and Ni(CO)<sub>4</sub>  
Second Week – Physical Properties of solvents and their types, general characteristics of solvents  
Third Week -- Reactions with reference to liquid NH<sub>3</sub>  
Fourth Week -- Reactions with reference to liquid SO<sub>2</sub>

January, 2022

- First Week – Basics of coordination chemistry, Werner's theory of coordination compounds  
Second Week – Chelates, effective atomic number, nomenclature of coordination compounds

Third Week -- Valence bond theory of transition metal complexes, Isomerism in coordination compounds

Fourth Week -- Test of unit I (d-block elements)  
Viva of unit III (coordination compounds)

Concerned Faculty- Dr. Sonika

Mrs. Preeti

**GOVERNMENT P.G COLLEGE FOR WOMEN, ROHTAK**  
Lesson plan, Odd Semester Session  
**2021-22**

**DEPARTMENT OF CHEMISTRY**  
**Physical Chemistry**

B.Sc. 2<sup>nd</sup> Year, Semester 3<sup>rd</sup> (Sections A, B, C and D)

**October 2021**

**First week-** Thermodynamic process, concept of heat and work

**Second week-** Oxidation state, magnetic and spectral properties

**Third week-** Zeroth law of thermodynamics

**Fourth week-** 1<sup>st</sup> law of thermodynamics concept of heat capacities

**November 2021**

**First Week -** Joules law, Joule-Thomson coefficient for real and ideal gas

**Second Week -** calculation of  $w, q, du, dH$  for the expansion of IDEAL GASES under isothermal condition

**Third Week -** calculation of  $w, q, du, dH$  for the expansion of IDEAL GASES under adiabatic conditions for reversible process

**Fourth Week -** temperature dependence of enthalpy,

**December 2021**

**First Week -** Kirchhoff's equation, Bond energies and applications of bond energies

**Second week -** Chemical equilibrium constant and free energy

**Third Week** -- concept of chemical potential, law of chemical equilibrium, vant hoff rxn isotherm and isochore.

**Fourth Week**— concept of chemical potential, law of chemical equilibrium, vant hoff rxn isotherm and isochore.

### **January 2022**

**First Week**-- Le-chatlier principle and clausius clapeyron equation

**Second week**— Nernst distribution law, modification of distribution law

**Third Week** – Application of distribution law.

**Fourth Week** - Test and assignments

Concerned Faculty- Dr. Deepak

Mrs. Monika

Mrs. Preeti

### **GOVERNMENT P.G COLLEGE FOR WOMEN, ROHTAK**

Lesson plan, Odd Semester Session

**2021-22**

DEPARTMENT OF **CHEMISTRY**

**Organic Chemistry**

B.Sc. 2<sup>nd</sup> Year, Semester 3<sup>rd</sup> (Sections A, B, C and D)

October, 2021

**First Week**-- Introduction, bond length

**Second week**— bond angle, localised and delocalised bonding

**Third Week** – vander waals interaction and hyperconjugation effect

**Fourth Week** - electromeric effect and their comparison

November, 2021

Week 1- inductive effect and field effect

Week 2-charge transfer comp

Week 3-sterieochemistry; introduction isomerism

Week 4- org optical isomerism,symmetry, chirality,entantiomers

December, 2021

First Week -- Stereochemistry of organic compound, enantiomerism,diasteiromers and their properties

Second Week- meso compounds, resolution of enantiomers inversion, retention, racemisation,inversion

Third Week -- Relative and absolute configuration, sequence rule

Fourth Week - R and S system of nomenclature, E and Z system of nomenclature of organic molecules

January, 2022

First Week -- Geometrical isomerism, Determination of configuration of geometrical isomers

Second Week- Conformational analysis of ethane and n-butane

Third Week -- conformations of cyclohexane, newman projection and Sawhorse projection formulae

Fourth Week- Test and Revision

Concerned Faculty- Dr. Nidhi

Mrs. Monika

**Government PG College for Women, Rohtak  
Lesson plan, Odd Semester Session  
2021-2022**

**Department of Chemistry**

**B.Sc. Ist semester (Medical & Non-Medical)**

**Organic Chemistry**

## October 2021

**Third week** -- Introduction, localized and delocalized chemical bonds

**Fourth week** -- Van der wall interactions, resonance conditions

## November 2021

**First week** -- Resonance effect and its applications, Hyperconjugation, Inductive effect

**Second week** -- Electromeric effect & their comparison, concept of isomerism, types of isomerism

**Third week** -- Elements of symmetry, Molecular chirality, Enantiomers, Stereogenic centres, Optical activity

**Fourth week** -- Property of enantiomers, chiral and achiral molecules with two stereogenic centres, Diastereomers, Meso compounds

## December 2021

**First Week** -- Resolution of Enantiomers, Inversion, Retention and Racemisation, Relative and absolute configuration, Sequence rule, R and S system of nomenclature.

**Second Week** -- Determination of configuration of geometrical isomers, E and Z system of nomenclature of organic molecules.

**Third Week** -- Conformational analysis of ethane and n-butane, conformations of cyclohexane, newman projection and Sawhorse projection formulae.

**Fourth Week** -- Curved arrow notions, drawing electron movements with arrows, half headed and double headed arrows, homolytic and heterolytic bond breaking, types of reagents-electrophiles and nucleophiles.

## January 2022

**First Week** --Types of organic reactions-addition reactions, substitution reactions,elimination reactions.

**Second Week** - Carbocations carboanions,free radicals carbenes arynes, and nitrenes.

**Third Week** - IUPAC nomenclature of alkanes ,classification of carbon atoms in alkanes. Isomerism in alkanes,source and methods of formation.

**Fourth Week** - Cycloalkane nomenclature, synthesis of cycloalkanes and their derivatives- photochemical cycloaddition reactions, Baeyer's strain theory and its limitations,

theory of strainless rings.

**Concerned Teacher: Mrs. Shammy Iaj  
Dr. Aarti Dalal  
Mrs. Manu Kumari**

**Government PG College for Women, Rohtak  
Lesson plan, Odd Semester Session  
2021-2022**

**Department of Chemistry**

**B.Sc. 1<sup>st</sup> Semester (Medical & Non-Medical)**

**Inorganic Chemistry  
October 2021**

**Third Week**

**Atomic structure:** Idea of de Broglie matter waves, Heisenberg uncertainty Principle.

Atomic orbital, quantum number, radial and angular wave

**Fourth Week**

Probability of angular wave function, shape of s, p, d and f-orbital

**November 2021**

**First week**

Aufbau and Pauli exclusion principle, Hund's multiplicity rule. Electronic configuration of elements

**Second week**

effective nuclear charge, Slater's rule. Classification of periodic table, atomic and ionic radii

**Third week**

periodic trends in ionic radii, Ionisation energy and its variation in periodic table, electronic affinity

**Fourth Week**

electronegativity definition, method of determination.

**December 2021**

**First week**

Trend in periodic table, Pauling, Mulliken, Allred and Mulliken's, Electronegativity scale, Sanderson's electron density ratio various types of hybridisation

**Second Week**

Valence bond theory and its limitations, Shape of inorganic molecules and ions,



**Covalent Bond** –VSEPR Theory and its applications, Molecular orbital diagram of homonuclear molecules

**Third week**

Molecular orbital diagram of heteronuclear diatomic molecules and ions. Bond energy, bond angle

**Fourth Week**

Percentage ionic character, dipole moment and electronegativity difference.

**January 2022**

**First week**

Ionic structures (NaCl, CaCl<sub>2</sub>, ZnS, CaF<sub>2</sub>)

**Second Week**

Radius Ratio Effect and coordination number & Limitations of radius ratio rule

**Third Week**

Lattice effects, semiconductor, lattice energy, Born-Haber cycle, solvation energy and its relation with solubility of ionic solids

**Fourth week** - polarising power and polarizability of ions, fajan's rule

Assignment and viva, test

**Concerned Teacher: Mrs. Shammy Iaj**  
**Mrs. Meena**  
**Mrs. Neha Sapra**

**Government PG College for Women, Rohtak**  
**Lesson plan, Odd Semester Session**  
**2021-2022**

**Department of Chemistry**

**B.Sc. 1<sup>st</sup> Semester (Medical & Non-Medical)**  
**Physical Chemistry**

**October 2021**

**Third Week**

**Gaseous States:** Maxwell 's distribution of velocities and energies ,calculation of root mean square velocity, average velocity and most probable velocity. collision diameter, collision number, collision frequency, mean free path.

**Fourth Week** - deviation of real gases from ideal behaviour, derivation of vander waals equation of states.

**November 2021**

**First week**

vander waals equation's application in calculation of boyle's temperature,

**Second week**

explanation of behaviour of real gases using vander waals equation.

**Third week**

**Critical Phenomenon:** critical temperature, volume, pressure and their determination.

**Fourth Week**

PV isotherms of real gases, continuity of states, isotherms of vander waals equation.

**December 2021****First week**

relationship between critical constant and vander waals constant, critical compressibility factor

**Second week**

the law of corresponding states, liquefaction of gases.

**Third week**

**Liquid states:** structure of liquid, properties of liquid, surface tension

**Fourth Week**

viscosity, vapour pressure and optical relations and their determination.

**January 2022****First week**

**Solid states:** classification of solids, law of crystallography-(1)law of constancy of interfacial angle,(2)law of rationality of indices, (3)law of symmetry. symmetry elements of crystals ,unit

cell and space lattice

**Second Week**

bravais lattice, crystal system, X-ray diffraction by crystals, derivation of Bragg's equation, crystal

structure of NaCl, KCl.

### **Third Week**

**liquid crystals:** difference between solid, liquid crystals and liquid, types and applications of liquid crystals.

**Fourth week – Revision,** assignment and viva, test

**Concerned Teacher: Mrs. Manu  
Mrs. Seema  
Mrs. Neha Sapra**

Government college for women Rohtak

Department of Chemistry

Bsc. 5<sup>th</sup> sem

INORGANIC CHEMISTRY

OCTOBER 2021

Week 1: Limitations of valence bond theory, an elementary idea of crystal-field theory

Week 2: crystal field splitting in octahedral, tetrahedral

week 3: crystal field splitting in square planar complexes, factors affecting the crystal-field parameters.

Week 4: Thermodynamic and Kinetic Aspects of Metal Complexes

## NOVEMBER 2021

Week 1: Test of first unit, A brief outline of thermodynamic stability of metal complexes

Week 2: factors affecting the stability, substitution reactions of square planar complexes of Pt(II).

Week 3: Magnetic Properties of Transition Metal Complexes

Week 4: Types of magnetic behaviour, methods of determining magnetic susceptibility,

## DECEMBER 2021

Week 1: spin-only formula. L-S coupling, correlation of  $s$  and  $eff$  values, orbital contribution to magnetic moments,

week 2: application of magnetic moment data for 3d metal complexes.

Group discussion.

Week 3: Problem discussion of syllabus covered, Electron Spectra of Transition Metal Complexes

## JANUARY 2022

Week 1: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states,

week 2: spectrochemical series. Orgel-energy level diagram for  $d^1$  and  $d^9$  states,

week 3: discussion of the electronic spectrum of  $[Ti(H_2O)_6]^{3+}$  complex ion.

Week 4: Problem discussion

Teacher concerned: Dr. Anita Singhal, Ms. Pooja Chaudhary, Ms. Suman Sheoran

## PHYSICAL CHEMISTRY:

### OCTOBER 2021

WEEK 1: Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Compton effect,

WEEK 2: wave function and its significance of Postulates of quantum mechanics, quantum mechanical operator, commutation relations, Hamiltonian operator,

week 3: Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics,

Week 4: To show quantum mechanically that position and momentum cannot be predicted simultaneously,

### NOVEMBER 2021

Week 1: Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

Week 2: Physical Properties and Molecular Structure Optical activity

Test of unit 1

Week 2: Clausius – Mossotti equation, Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method,

Week 3: Dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination.

Week 4: Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism.

DECEMBER 2021

Week 1: Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-Oppenheimer approximation, Degrees of freedom. Rotational Spectrum Diatomic molecules

Week 2: Energy levels of rigid rotator, selection rules, spectral intensity distribution using population distribution, determination of bond length,

Week 3: Qualitative description of non-rigid rotor, isotope effect, Vibrational spectrum Infrared spectrum, Energy levels of simple harmonic oscillator, selection rules,

Week 4: Pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies,

JANUARY 2022

Week 1: Effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Problem discussion with students

Week 2: Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules,

Week 3: Selection rules, Quantum theory of Raman spectra.

Week 4: Group discussion, test of unit 3

Teacher concerned: Ms. Pooja chahal, Ms. Pooja chaudhary

Organic chemistry

OCTOBER 2021

WEEK 1: Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons,

WEEK 2: positions of signals and chemical shift, shielding and deshielding of protons,

WEEK 3: proton counting splitting of signals and coupling constants, magnetic equivalence of protons.

WEEK 4: Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide,

NOVEMBER 2021

WEEK 1: 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone.

WEEK 2: Simple problems on PMR,

WEEK 3: spectroscopy for structure determination of organic compounds.

Test of unit 1

Week 4: Classification and nomenclature of carbohydrates

DECEMBER 2021

WEEK 1: Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose,

Week 2: chain lengthening and chain shortening of aldoses. Configuration of monosaccharides.

Week 3: Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters.

Week 4: 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.

JANUARY 2022

WEEK 1: An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

WEEK 2: Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions.

WEEK 3: Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

WEEK 4: Group discussion and problem solving with students

Teacher concerned: Mrs. Savita pruthi, Ms.Poojachaudhary, Ms. SumanSheoran, Ms. Vijieta

Government College for Women, Rohtak  
Lesson plan, Odd Semester Session  
2021-2022

Department of Chemistry  
Name of extension lecturer: **SANGITA**  
B.Sc. 1 (Home Science) 1<sup>st</sup> semester

**October 2021**

- Third Week -- Concept of element, mixture and compound, atomic and molecular masses, mole concept and molecular masses
- Fourth Week -- Normality, molarity and mass percentage. Simple numerical problems based on them

**November 2021**

- First Week -- -Diwali Vacations**
- Second Week --** Subatomic particles: Electrons, protons and neutrons. Atomic no., Atomic weight, Bohr's Atomic Model
- Third Week -- Modern periodic law and periodic table. Electronic configuration of elements (Na, Mg, C, N, O, F, Cl, H)
- Fourth Week -- Periodic properties: atomic size, ionisation energy Electron affinity, Electronegativity
- Fifth Week -- .Chemical bonding: Ionic Bonding, Covalent Bonding, Coordinate, H-Bonding.

**December 2021**

- First week -- Concepts of acids, base and salt, pH and pH scale. Numerical based on pH and buffer solutions.
- Second Week- Carbon and its characteristics- Tetravalency, catenation Electronegativity tendency to form multiple bonds. Organic compounds, classification of organic compounds, Functional groups
- Third Week-- IUPAC nomenclature of aliphatic compounds (alkanes, alkenes, alkynes)
- Fourth Week -- IUPAC nomenclature of aliphatic compounds (alcohols, carboxylic acids, aldehydes and ketones).
- Fifth Week -- Practice of IUPAC nomenclature.



## **JANUARY 2022**

- First Week-- Soap and Synthetic Detergents, Advantages and Disadvantages.  
Synthetic polymer: Structure and uses of the following polymers (PVC,  
Teflon,PAN,Nylon-6,6)
- Second Week -- Chemical composition in cosmetics-creams, perfumes, talcum powder,  
deodorants, lipstics, nailpolish, shampoo and hair dye.
- Third Week -- Paints and Varnishes their composition and uses.
- Fourth Week-- Revision