ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (APSIC) Industrial Chemistry						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
II	Chemistry DSC-C 2	Periodic Properties and Chemical bonding	**2**			**2**
Teacher/Instructor(s)		Dr. Neha Bhardwaj				
Session		2022-2023				

Course Objective:

- The course discusses the periodicity in properties with reference to the s, p and d block, which is necessary in understanding their group chemistry.
- It provides basic knowledge about ionic, covalent and metallic bonding underlining the fact that chemical bonding is best regarded as a continuum between the three cases.
- It provides an overview of hydrogen bonding and van der Waal's forces which influence the melting points, boiling points, solubility and energetics of dissolution of compounds.

Learning Outcomes

On completion of the course, the student will be able to:

• Understand periodicity in ionization enthalpy, electron gain enthalpy, electronegativity and enthalpy of atomization.

• Understand variability in oxidation state, colour, metallic character, magnetic and catalytic properties and ability to form complexes

• Understand the concept of lattice energy using Born-Landé expression.

• Draw Born Haber Cycle and analyse reaction energies.

• Draw the plausible structures and geometries of molecules using VSEPR theory.

• Understand and draw MO diagrams (homo- & hetero-nuclear diatomic molecules).

• Understand the importance and applications of hydrogen and van der Wall bonding.

Lesson Plan:

S. NO.	**Learning Objective**	**Lecture No.**	**Topics to be covered**
I	Periodic Properties	1-2	Electronic configurations of the atoms.
		3-4	Stability of half-filled and completely filled orbitals
		5-6	concept of exchange energy, inert pair effect.
		7-8	General group trends of s, p and d block elements with special reference to Ionization Enthalpy

		9-10	Electron Gain Enthalpy, Electronegativity, Enthalpy of Atomization, oxidation state
		11-12	colour, metallic character, magnetic and catalytic properties, ability to form complexes
II	Chemical Bonding	13-14	Ionic Bonding: General characteristics of ionic bonding, Lattice Enthalpy and Solvation Enthalpy and their relation to stability and solubility of ionic compounds
		15-16	Born-Lande equation for calculation of Lattice Enthalpy (no derivation)
		17-18	Born-Haber cycle and its applications, polarizing power and polarizability
		19-20	Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character
		21-22	**Covalent Bonding**: Valence Bond Approach, Hybridization and VSEPR Theory with suitable examples
		23-24	Concept of resonance and resonating structures in various inorganic and organic compounds, Molecular Orbital Approach: Rules for the LCAO method
		25-26	bonding, nonbonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals
		27-28	MO treatment of homonuclear diatomic molecules of 1_{st} and 2_{nd} periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^{+}.
		29-30	Brief introduction to Metallic Bonding, Hydrogen Bonding, van der Waal's Forces

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		20
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	2 hr	60

Details of the Course		
Unit	**Contents**	**Contact Hours**
1 **Periodic Properties**	Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy, inert pair effect. General group trends of s, p and d block elements with special reference to Ionization Enthalpy, Electron Gain Enthalpy,	12

	Electronegativity, Enthalpy of Atomization, oxidation state, colour, metallic character, magnetic and catalytic properties, ability to form complexes	
2 **Chemical Bonding**	**Ionic Bonding**: General characteristics of ionic bonding, Lattice Enthalpy and Solvation Enthalpy and their relation to stability and solubility of ionic compounds, Born-Lande equation for calculation of Lattice Enthalpy (no derivation), Born-Haber cycle and its applications, polarizing power and polarizability, Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. **Covalent Bonding**: Valence Bond Approach, Hybridization and VSEPR Theory with suitable examples, Concept of resonance and resonating structures in various inorganic and organic compounds, Molecular Orbital Approach: Rules for the LCAO method, bonding, nonbonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Brief introduction to Metallic Bonding, Hydrogen Bonding, van der Waal's Forces	18
	Total	**30**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Huheey, J.E.; Keiter, E.A., Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education	2009
2	Shriver, D.D.; Atkins, P.; Langford, C.H. (1994), Inorganic Chemistry 2nd Ed., Oxford University Press.	1994
3	Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), **Inorganic Chemistry**, 5th Edition, W. H. Freeman and Company.	2010
4	Lee, J.D.; (2010), Concise Inorganic Chemistry, Wiley India	2010
5	Douglas, B.E.; McDaniel, D.H.; Alexander, J.J. (1994), Concepts and Models of Inorganic Chemistry, John Wiley &	1994

	Sons.	
6	Wulfsberg, G (2002), Inorganic Chemistry, Viva Books Private Limited.	2002
7	Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014), Inorganic Chemistry, 5th Edition, Pearson.	2014
Mode of Evaluation:	Internal Assessment / End Semester Exam	