



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. Industrial Chemistry						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
IV	42174404	Chemistry of s- and p-Block Elements, States of Matter and Chemical Kinetics	4			4
Teacher/Instructor(s)		Dr. Nidhi Dureja and Dr. Nimalini Moirangthem				
Session		2021-22				

Course Learning Outcomes:

By the end of the course, the students will be able to:

- Understand the basics concepts of metallurgy and techniques applicable for purifications of different metals
- Chemistry and applications of s- and p-block elements and their compounds.
- Derive ideal gas law from kinetic theory of gases and deviation from ideal behaviour.
- understand Maxwell-Boltzmann distribution, critical constants and viscosity of gases.
- Understand the properties of liquids especially surface tension and viscosity.
- Understand the symmetry elements, crystal structure of NaCl, KCl and CsCl
- Understand the rate of reactions and the factors that affect the rates of reaction.
- Understand the concept of rate laws and various terms like order, molecularity, half-life and their determination
- Learn about various theories of reaction rates and how these account for experimental observations.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1	General Principles of Metallurgy: (Lectures: 4)	1	Chief modes of occurrence of metals based on standard electrode potentials.
		2	Ellingham diagrams for reduction of metal oxides using carbon as reducing agent.
		3	Hydrometallurgy with reference to cyanide process for silver and gold, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn):
		4	electrolytic, oxidative refining, van Arkel-de Boer process, Mond's process and Zone Refining

2	s- and p- block elements(Lectures: 26)	5-8	Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy
		9-10	electronegativity (Pauling, Muliken, and Allred-Rochow scales).
		11-12	Allotropy in C, S, and P
		13-15	Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides)
		16	inert pair effect
		17-18	diagonal relationship and anomalous behaviour of first member of each group. ,
	compounds of s- and p-block elements	19-20	diborane and concept of multicentre bonding.
	Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial and environmental chemistry	21-23	Hydrides of nitrogen (NH ₃ , N ₂ H ₄ , N ₃ H, NH ₂ OH)
		24-27	Oxoacids of P, S and Cl
		28-30	Halides and oxohalides: PCl ₃ , PCl ₅ , SOCl ₂ and SO ₂ Cl ₂

Unit No.	Learning Objective	Lecture No.	Topics to be covered
3	Kinetic Theory of Gases : (Lectures: 10)	1	Kinetic Theory of Gases Postulates of kinetic theory of gases and derivation of the kinetic gas equation
		2	Kinetic Theory of Gases Postulates of kinetic theory of gases and derivation of the kinetic gas equation
		3	deviation of real gases from ideal behaviour, compressibility factor,
		4	causes of deviation, van der Waals equation of state for real gases.
		5	Boyle temperature (derivation not required), critical phenomena, critical constants and their calculation from van der Waals equation,
		6	Andrews isotherms of CO ₂ , Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.
		7	Andrews isotherms of CO ₂ , Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

		8	Temperature dependence of these distributions, most probable, average and root mean square velocities (no derivation), collision cross section,
		9	collision number, collision frequency, collision diameter and mean free path of molecules,
		10	viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).
4	Liquids(Lectures: 3)	11	Liquids Surface tension and its determination using stalagmometer,
		12	Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer,
		13	effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).
5	Solids, (Lectures: 6)	14	Solids Forms of solids, symmetry elements, unit cells, crystal systems,
		15	Bravais lattice types and identification of lattice planes. Laws of crystallography - law of constancy of interfacial angles.
		16	Law of rational indices, Miller indices
		17	X-ray diffraction by crystals, Bragg's law
		18	structures of NaCl, KCl and CsCl (qualitative treatment only), defects in crystals
		19	Glasses and liquid crystals.
6	Chemical Kinetics : (Lectures: 11)	20	The concept of reaction rates,
		21	effect of temperature, pressure, catalyst and other factors on reaction rates.
		22	Order and molecularity of a reaction,
		23	integrated rate equations for zero
		24	integrated rate equations for zero
		25	derivation of, half-life of a reaction, general methods for determination of order of a reaction,
		26	Concept of activation energy and its calculation from Arrhenius equation.
		27	Concept of activation energy and its calculation from Arrhenius equation.
		28	Theories of reaction rates: Collision theory and activated complex theory of bi
		29	Theories of reaction rates: Collision theory and activated complex theory of bi
		30	Comparison of the two theories (qualitative treatment only)

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		

	<ul style="list-style-type: none"> • Attendance • Assignment 		
2.	End Semester Examination	3.5 hr	75

Suggested Books:		
Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Lee., J. D., A new Concise Inorganic Chemistry, Pearson Education.	2010
2	Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. ,Shriver and Atkin's Inorganic Chemistry, Oxford.	2010
3	Miessler, G. L.; Tarr, D.A, Inorganic Chemistry, Pearson	2014
4	Cotton, F.A.; Wilkinson, G.; Gaus, P.L., Basic Inorganic Chemistry, 3rd Edition,Wiley India.	1995
5	Castellan, G. W,Physical Chemistry, Narosa..	2004
6	Kapoor, K.L.,A Textbook of Physical Chemistry, Vol.1, 6th Edition, McGraw Hill Education.	2015
7	Kapoor, K.L.,A Textbook of Physical Chemistry, Vol.5,3rd Edition, McGraw Hill Education.	2015
8	B.R.Puri, L.R.Sharma, M.S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co	2017
Mode of Evaluation:		Internal Assessment / End Semester Exam