

CHEMISTRY-II (INORGANIC CHEMISTRY)

CREDIT HOURS: 3

COURSE OBJECTIVES

The program is aimed that the student should learn:

1. The Development of periodic law and properties of elements in a systematic way.
2. The principal of chemical bonding
3. The Chemistry of acid and bases
4. The Chemistry of p-block Elements
5. The Chemistry of d- block Elements
5. The fundamental principles of industrial process

COURSE CONTENT:

1. The Structure of the Atom

Inner picture of an atom: Subatomic particles, models of the atom described by Rutherford and Bohr, Energy of an electron, Radius of an orbit, Origin of spectral lines in different: elements. Sommerfeld's modification.

2. Periodicity

Modern periodic table; Similarities and differences in first row elements, their diagonal and vertical relationship with other elements; Electro negativity of elements (Pauling and Mullikan scales); Polarizability and polarizing power of ions; Periodicity in the properties of transition and inner transition elements.

3. Theories of Chemical Bonding

Nature and types of chemical bonding; Modern concept of valence bond theory (VBT), molecular orbital theory (MOT) and their applications to homo and hetero di-and polyatomic inorganic molecules, explaining the conventional and modified MO diagrams; Valence shell electron pair repulsion theory (VSEPR), explaining the shapes of inorganic molecules (i.e. AB_2 , AB_3 , AB_2E , AB_4 , AB_3E , AB_2E_2 , AB_5 , AB_4E , AB_3E_2 , AB_2E_3 , AB_6 , AB_5E , AB_4E_2) and directed valence theory (Hybridization), Metallic bonds (detailed concept).

1. Acid-Base Concept

General concept of acids and bases. Detail of Lewis concept of acids and bases; Soft and hard acid-base (SHAB) concept and its applications. Relative strength of acids and bases based on P_k values. Reactions of acids and bases. Relationship between redox reactions and acid base reactions. Indicators and theory of indicators.

5. Chemistry of d-Block Elements

Electronic configuration and oxidation states of transition elements. Metallurgy of chromium, nickel and copper. Theories of coordination compounds, valence bond theory (VBT), molecular orbital theory (MOT) and crystal field theory (CFT) for tetrahedral and octahedral complexes. Nomenclature and Isomerism in coordination compounds. Chelates. Application of coordination compounds.

6. Nuclear Chemistry

Phenomena of radioactivity; Natural radioactivity, Radioactive disintegration series, rate of disintegration and half life period, Mass defect and binding energy, nuclear stability; measurement of nuclear radiation, Wilson cloud chamber and Geiger-Muller counter, Carbon dating; Artificial radioactivity and nuclear transformations, Nuclear reactions (fission and fusion), Uses of radioactive isotopes; Biological effect of nuclear radiation.

Chemical Industries

Glass, Soda ash and Soap.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Recommended Books:

1. Cotton, F, Albert, Geoffrey Wilkinson and Paul L. Gaus, "Basic Inorganic Chemistry", John, Wiley & Sons Inc, 3rd Edition (1995).
2. Lee, J.D., "Modern Inorganic Chemistry", Chapman & Hall, 5th Edition (1996).
3. Jolly, William, L., "Modern Inorganic Chemistry", McGraw Hill, 2nd Edition (1991).

4. Shriver, D.F., P.W. Atkins and C.H. Langford, "Inorganic Chemistry", Oxford, 2nd Edition (1996).
5. Sharp, A.G. "Inorganic Chemistry", Longman, 3rd Edition (1992).
6. Rayner Canham, Geiof., "Descriptive Inorganic Chemistry" & Co. (1995).
7. Jefferey, G.H., j. bassett, J.Mendham and R.C. Denney, "Vogel's text book of Quantitative Chemical analysis", 5th Edition, Benjamin Cummings, (1989).

TITLE: CHEMISTRY LAB-II (INORGANIC CHEMISTRY)

CREDIT HOURS: 1

PAPER CHROMATOGRAPHY

Separation & identification of cations/basic radicals of group I, II.A, II.B & III. Also calculate their R_f values.

ARGENTOMETRY

MOHR'S METHOD

- 1) Determine the %age purity of NaCl (rock salt)
- 2) Determine the amount of NaCl in the commercial sample of soda ash.

VOLHARD'S METHOD

- 1) Determination of %age purity of HCl.
- 2) Determination of silver in the given sample, using KSCN or NH_4SCN .

REDOX TITRATIONS (By using both internal and external indicators)

- 1) Determination of amount/ dm^3 of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ with $\text{K}_2\text{Cr}_2\text{O}_7$.
- 2) Determination of %age purity of $\text{K}_2\text{Cr}_2\text{O}_7$ by using standard solution of Mohr's salt.
- 3) Determination of number of water molecules (x) in $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$ using $\text{K}_2\text{Cr}_2\text{O}_7$.
- 4) Determination of Ca^{2+} by KMnO_4 .
- 5) Determination of %age of iron in ferric alum $(\text{NH}_4)_2\text{SO}_4 \cdot \text{Fe}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ using $\text{K}_2\text{Cr}_2\text{O}_7$.

COMPLEXOMETRY

- 1) Standardization of EDTA solution by magnesium/zinc sulfate solution.
- 2) Find out the amount of Ca^{2+} in the given sample of marble (lime stone).
- 3) Determination of Ca^{2+} and Mg^{2+} in the sample by using EDTA.

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External Examination	Final Semester	60%

Books Recommended:

1. Vogel, "A.I.A. Text Book of Macro and Semi micro-qualitative Inorganic Analysis", Longman Green & Co., (1995).
2. Skoog, D.A., D.M. West and F.J. Holler, "Analytical Chemistry", 6th Edition, Saunders College Publications, (1994).
3. Javed Iqbal, Amin, "Theory and Practice of chromatography", Higher Education Commission, Islamabad, (2002).