

Semester	AUG 2022
Open to semester	5,7,11,13,21
Course code	CH3124/CH6124
Course title	Main Group Chemistry
Credits	4 /4
Course Coordinator & participating faculty (if any)	Moumita Majumdar
Nature of Course	Lectures
Pre-requisites	basic concepts on Lewis structure, hybridization model and Molecular Orbital Theory
Objectives (goals, type of students for whom useful, outcome etc)	The objective of this course is to focus on the chemistry of main group elements such as hydrogen, alkali metals and p-block elements from group 13 – 18 of the periodic table. The central theme of this course is to give a detailed account on the fundamental concepts relevant to structure and bonding, acids and bases, redox behavior, reactions and applications of the main group elements and their compounds. In addition to providing a necessary foundation for inorganic chemistry, this course will also emphasize the role of main group compounds in multi disciplinary areas of chemistry such as supramolecular, organometallic, materials science and catalysis.
Course contents (details of topics /sections with no. of lectures for each)	<p>Section #1- General Chemistry: (9 hrs) The covalent bond: Bonding theories, MO theory of di- and polyatomic molecules; Acids and bases: technical application of the concepts of acids and bases; main group based Lewis acids and their anion sensor applications, introduction to frustrated Lewis acid-base adducts and their applications.</p> <p>Section #2- Hydrogen: (2 hrs) Atomic and physical properties of hydrogen; The classical hydrogen bond; Water; Hydrates; Hydrogen ions; Metal hydrides; Activation of hydrogen complexes.</p> <p>Section #3 Chemistry of Group 1 and 2 Elements: (2 hrs) The elements and their properties; Alkali metals in liquid ammonia and other solvents; Coordination complexes.</p>

Section #4- Chemistry of Group 13 Elements: (7 hrs)

The elements and their properties; Chemistry of Boron; Borides; Boron hydrides (Preparation, structure, bonding, reactions and properties); Carboranes; Boron halides, Boron-Nitrogen chemistry; Boron-Oxygen chemistry; Aluminium-alkyls and -halides: structure, property and applications.

Section #5- Chemistry of Group 14 Elements: (7 hrs)

The elements and their properties; Allotropy of Carbon: Diamond, Graphite, and Fullerenes; Intercalation; Compounds with C-N, C-O, C-S bonds C-X (halogen) bonds; Silane reagents, double bond rule in heavier main group elements, synthesis and properties of disilene, disilynes and polysilanes; Silicides; Silicone Polymers; Oxygen compounds of silicon; overview of the chemistry and properties of Germanium and Tin.

Section #6- Chemistry of Group 15 Elements: (5 hrs)

The elements and their properties; Nitrides; Hydrides of Nitrogen; Oxides of Nitrogen; Oxo acids and anions of Nitrogen; Activation of Nitrogen; Nitrogen fixation; Reaction of coordinated NO; Phosphides; Phosphorous halides and oxides; Oxoacids of phosphorous and their salts; Phosphorous-Nitrogen compounds and polymers.

Section #7- Chemistry of Group 16 Elements: (4 hrs)

The elements and their properties; Singlet Oxygen; Ozone; Complexes of molecular oxygen; N-S compounds; Sulfides; Oxides and oxoacids of sulfur; Chalcogenides, Polychalcogenides and Zintl phases.

Section #8- Chemistry of Halogens: (2 hrs)

The elements and their properties; Halides; Polyhalides; Interhalogen compounds; Charge-transfer complexes of Halogens.

Section #9- The Noble Gases: (1 hrs)

The elements and their properties; Compounds of Xenon and other noble gases.

Section #10- Main Group Organometallic Chemistry: (3 hrs)

	Energy, polarity, and reactivity of M-C bond; Organometallic chemistry of alkali and alkaline-earth metals. Organometallic compounds of Boron, Carbon and Nitrogen group of elements and their properties.
Evaluation /assessment	End-Sem Examination-45% Mid-Sem Examination-35% Others-20%
Suggested readings (with full list of authors, publisher, year, edn etc.)	<ul style="list-style-type: none"> a. Inorganic Chemistry by Shriver & Atkins (4th Ed.) b. Inorganic Chemistry by Huheey, Keiter, keiter, medhi (4th Ed.) c. Advanced Inorganic Chemistry by Cotton, Wilkinson, Murillo and Bochmann (6th Ed.). d. Chemistry of the Elements by Greenwood and Earnshaw (2nd ed.) e. Concise Inorganic Chemistry by J. D. Lee (5th Ed.) f. Organometallics by Christoph Elschenbroich (3rd Ed.)