COURSE & PROGRAM OUTCOMES
OF
CHEMISTRY HONOURS (B.SC.)
UNDER CBCS

The CBCS Course curriculum of the discipline of Chemistry is well designed and very promising. The core course would help to enrich the subject knowledge of the students and increase their confidence level in the field of both academia and industry. Generic electives make integration among various interdisciplinary courses to fulfill the vision and mission of designing the course. The introduction of Skill Enhancement Courses (SEC) would help to gain more powerful knowledge not only in their core Chemistry subject but also in interrelated multidisciplinary subjects both theoretically and practically. The inclusion of Discipline Specific Courses (DSE) has brought an opportunity in front of students to gain knowledge on various naturally and industrially important useful materials and also helps them to familiar and expert in handling different chemistry based software after proper training. In brief the student graduated with this type of curriculum would be able to disseminate subject knowledge along with necessary skills to suffice their capabilities for academia, entrepreneurship and industry.

After careful analysis of the course, the department of Chemistry has pointed out the following outcomes of the course.

Course Outcomes

Semester	Course Code	Course Outcomes
	CC-1	**CO-1:** To know extra nuclear structure of atom **CO-2:** To understand acid base reactions **CO-3:** To know the basic concepts of redox reactions **CO-4:** To learn the basics concepts of organic chemistry specially on chemical bonding and physical properties **CO-5:** To study the estimation of ions or salts by acid-base titration method and oxidation-reduction titration method

SEM-I		**CO-6:** To learn experimentally about the separation of compounds from a solid binary mixture by using common laboratory reagents
	CC-2	**CO-1:** To understand the basic concept of kinetic theory of gases and know how to solve numerical problems related to that topic. **CO-2:** To learn the transport processes of liquids and gases. **CO-3:** To understand rate laws, rate equations of different types of reactions, determine rate constant values, order of reactions, effect of temperature and other factors on reaction rate, homogenous catalysis, catalytic effect on reaction rate, equations related to chemical catalysis **CO-4:** To learn the basic concepts of Stereochemistry **CO-5:** To understand about the formation and stability of reaction intermediates and their electrophilic and nucleophilic behavior. **CO-6:**To study the kinetics of decomposition of H_2O_2, acid-catalyzed hydrolysis of methyl acetate, viscosity measurement of unknown liquids, measurement of solubility of sparingly soluble salts. **CO-7:** To understand experimentally how to determine the boiling points of organic liquid compounds.
SEM-2	**CC-3**	**CO-1:** To learn stereochemistry of chiral compounds arises due to presence of stereo-axis; concept of prostereoisomerism and concept of conformations of stereo isomers. **CO-2:** To understand reaction kinetics, reaction thermodynamics and tautomerism of organic compounds. **CO-3:** To know the concept, types, reaction mechanism and examples of elimination, free-radical and nucleohilic substitution reactions. **CO-4:** To learn experimentally how to synthesize, calculate the yield and determine the melting point of pure organic compounds in the laboratory.
	CC-4	**CO-1:** To learn about the basic concepts and types of chemical bonding, laws, rules and equations for formation of chemical bonds, solubility, hybridization and dipole moment of molecules. **CO-2:** To study the modern approaches of chemical bonding (Molecular Orbital Theory, Metallic Bonding conept, Role of weak intermolecular forces) **CO-3:** To understand about the concept of radioactivity and radioactive compounds, nuclear reactions, artificial radioactivity, radio carbon dating, hazards of radiation and safety measures. **CO-4:** To know experimentally how to estimate the percentage of chlorine in bleaching powder; vitamin C; arsenic and antimony in a sample by iodimetric titration method. Students can also learn how to estimate Cu in brass, Cr and Mn in steel and Fe in cement.
	CC-5	**CO-1:** To learn in detail about the first and second laws of Chemical Thermodynamics and the related terms; to get idea about thermo-chemistry and thermodynamic relationships and system of variable compositions. **CO-2:** To gain vast knowledge on chemical equilibrium and electrochemistry. **CO-3:** To learn experimentally how to do the potentiometric and conductometric titrations of different compositions, determine the Ka of weak acid and heat of neutralization of a strong acid by a strong base.
	CC-6	**CO-1:** To study in detail about modern periodic table, physical and chemical properties of the elements along a group or period, factors influences those properties, relativistic effects and inert pair effect. **CO-2:** To study the chemistry of s and p block elements including noble gases and their compounds in detail. **CO-3:** To learn about inorganic polymers in detail.

SEM-3		**CO-4:** To know the meaning of various terms involved in co-ordination chemistry, Werner's theory for complex formation, structural and stereoisomerism of co-ordination complexes. **CO-5:** To learn the complexometric and gravimetric estimation of different ions, chromatographic separation of (i) Ni (II) and Cu (II) ions, (ii) Fe (III) and Al (III) ions.
	CC-7	**CO-1:** To learn in detail about the synthesis, properties, chemical reactions and reaction mechnisms of alkenes and alkynes **CO-2:** To understand about different types of electrophilic and nucleophilic aromatic substitution reactions, reaction intermediates and their mechanisms. **CO-3:**To study the properties and reactions of carbonyl compounds and corresponding reaction mechanisms. **CO-4:**To learn preparations, reactions and corresponding reaction mechanisms of organometallic compounds. **CO-5:** To study experimentally the qualitative detection solid and liquid organic compounds. **CO-5:** To learn experimentally the quantitative estimation of organic compounds by titration method.
	SEC-A	**SEC-1. MATHEMATICS AND STATISTICS FOR CHEMISTS** **CO-1:** Helps to understand functions, differential equations, probability, vectors, matrices and determinants. **CO-2:** To learn about qualitative and quantitative aspects of analysis and helps to understand how to present a data after analysis. **SEC-2. ANALYTICAL CLINICAL BIOCHEMISTRY** **CO-1:** Helps to understand about the preparation, structures, reactions and biological importance of carbohydrates, proteins, enzymes, lipids and lipoproteins. **CO-2:** To know the biochemistry of different diseases through a diagnostic approach by blood and urine analysis. **CO-3:** To learn how to isolate proteins and how to perform the qualitative estimation of carbohydrate, proteins and lipids. **CO-4:** To study the quantitative estimation of carbohydrate, cholesterol, nucleic acids, determination of the iodine number of oil and saponification number of oil.
SEM-4	**CC-8**	**CO-1:** To understand in detail about the synthesis, separation, properties, identification, chemical reactions and their corresponding mechanism of nitrogen containing compounds. **CO-2:** Discussion about different kinds of rearrangement reactions. **CO-3:** Helps to know the logic of organic synthesis **CO-4:** To study UV-Visible, IR and NMR spectroscopy in detail. **CO-5:** Helps to know experimentally the qualitative analysis of single solid organic compounds
	CC-9	**CO-1:** Helps to understand about the applications of Thermodynamics in Colligative Properties and Phase Equilibrium **CO-2:** To study the fundamentals of Quantum Mechanics **CO-3:** Helps to know the Bravais Lattice and Laws of Crystallography, Crystal Planes and Specific Heat of Solid **CO-4:**To know experimentally how to study phase diagram of a Phenol-Water system, kinetic study of inversion of cane sugar, determination of partition co-efficient

		value, pH of an unknown solution and pH metric titration of an acid against strong base.
	CC-10	**CO-1:** Helps to understand about the structures, stability, colour, magnetism and Orgel diagram of the co-ordination compounds on the basis of modern concepts of chemical bonding. **CO-2:** To study the chemical and physical properties of d and f Block elements and their compounds. **CO-3:** To learn the reaction kinetics and mechanisms of inorganic reactions. **CO-4:** To study experimentally how to synthesize inorganic complexes and determine the λ_{max} values of inorganic complexes. **CO-5:** To calculate the 10Dq value by spectrophotometric method.
	SEC-B	**SEC-3. PHARMACEUTICALS CHEMISTRY** **CO-1:** Helps to understand about the drug discovery, design and development of representative drugs of the following classes: Antipyretic, Analgesics, Anti-inflammatory, Anti-bacterial, Antifungal, Antiviral, Antibiotics, Anti-laprosy, Central Nervous System agents, HIV-AIDS related drugs **CO-2:** To know about aerobic and anaerobic fermentation, importance of Vitamins and Amino acids, synthesis of Penicillin, Cephalosporin, Chloromycetin, Streptomycin and their role as an antibiotic. **CO-3:** To learn experimentally how to prepare aspirin in the laboratory and how to analyze it. **CO-4:** To learn experimentally how to prepare magnesium bisilicate in the laboratory. **SEC-4. PESTICIDE CHEMISTRY** **CO-1:** Helps to understand about the preparation, structures, properties, reactions, benefits and adverse effects of pesticide compounds **CO-2:** Helps to understand how to calculate acidity/ alkanility in a given sample of pesticide formulations as per BIS specifications. **CO-3:** To learn experimentally how to prepare organophosphates, phosphonates and thiophosphates. **CO-4:** To study how to prepare inorganic complexes in the laboratory. **CO-5:** To know how to determine the co-ordination compounds by spectrophotometric method
	CC-11	**CO-1:** Helps to understand the fundamental concept, basic terms, derivation and application of Quantum Mechanics **CO-2:** To know about the necessary laws, rules, terms, expressions and derivations statistical thermodynamics **CO-3:** To learn laws, rules and equations for numerical analysis of Roots of Equation and Least-Squares Fitting. **CO-4:** To study about the Computer Programming on Roots of equation, Numerical differentiation and Numerical integration.
		CO-1: To learn in detail about the synthesis, properties, chemical reactions and reaction mechanisms of polynuclear hydrocarbons and their derivatives. **CO-2:** To study the chemical reactions, properties and synthesis of heterocyclic compounds. **CO-3:** To know in detail about the stereochemistry, properties and chemical

SEM-5	**CC-12**	reactions of alicyclic compounds. **CO-4:** To learn the mechanism, stereochemistry and regioselectivity of pericyclic reactions. **CO-5:** Helps to understand about the classification, structure, properties, reactions and use of carbohydrate molecules. **CO-6:** Deals with the synthesis, structure, properties, chemical and biological reactions of amino acids, peptides and nucleic acids. **CO-7:** To learn experimentally how to separate molecules by chromatographic methods **CO-8:** To study how to analyze the Organic compounds by spectroscopic techniques.
	DSE	**A-1. MOLECULAR MODELLING & DRUG DESIGN** **CO-1:** Helps to learn about Molecular Modelling, Force Fields, Energy Minimization and Computer Simulation. **CO-2:** To study about Molecular Dynamics & Monte Carlo Simulation, Structure Prediction and Drug Design. **CO-3:** To learn how to optimize C-C bond lengths in different Organic molecules, Visualize the molecular orbitals, electron density and electrostatic potential maps of different molecules, perform a conformational analysis of molecules, relate the acidity of hydrogen halides and basicity of nitrogen containing bases. **CO-4:** To study how to compare the shapes of molecules, build and minimize organic compounds containing various functional groups, compute resonance energy of different molecules and determine the heat of hydration values. **A-2. APPLICATIONS OF COMPUTERS IN CHEMISTRY** **CO-1:** Helps to understand about the basics of computer programming (FORTRAN), creating and application of spreadsheet software (MS Excel) **CO-2:** Helps to know about statistical data analysis. **CO-3:** To learn how to prepare graphs by using spreadsheet, help to determine vapour pressure, rate constant, equilibrium constant, molar extinction coefficient value, concentration of ions at equilibrium and molar enthalpy of vapourisation. **CO-4:**To study about the Acid-Base Titration Curve, Plotting of First and Second derivative Curve for pH metric and Potentiometric titrations, Calculation and Plotting of a Precipitation Titration Curve with MS Excel, Michaelis-Menten Kinetics for Enzyme Catalysis using Linear and Non - Linear Regression. **B-1. INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE** **CO-1:** Helps to understand about the manufacture, properties, compositions, classes and applications of industrially important materials such as ceramics, glasses, cements, fertilizers, surface coating materials and batteries. **CO-2:** To know about alloys, manufacture of steel, composition and properties of different types of steels. **CO-3:** To learn about the general principles, properties, classification, industrial use, deactivation and regeneration of catalysis. **CO-4:** Helps to understand about the preparation and explosive properties of organic and inorganic explosives and the basic idea of rocket propellant.

		CO-5: To learn how to analyze the composition of cement, composition of percentage of metals in alloy, electroless metallic coatings on ceramic and plastic. **CO-6:** To know how to determine free acidity in ammonium sulphate fertilizer, estimation of Calcium in Calcium ammonium nitrate fertilizer and phosphoric acid in superphosphate fertilizer. **B-2. NOVEL INORGANIC SOLIDS** **CO-1:** To learn about the synthesis and modification of inorganic solids and their technological importance **CO-2:**To study the overview of nanostructures and nanomaterials; to know the preparation, classification, control of self-assembly and use of nanomaterials as bio-nanocomposite, nanotube, nanowire and other bio-functional materials. **CO-3:** To learn about the engineering materials specially composite materials for mechanical construction. **CO-4:** To know about the manufacturing, properties, classification and application of conducting polymer materials. **CO-5:** To understand how to synthesize hydro-gel by co-precipitation method and silver and gold nanoparticles. **CO-6:** Determination of ions by cation exchange method and total difference of solids in a composite material.
SEM-6	**CC-13**	**CO-1:** To study the Theoretical Principles in Qualitative Analysis **CO-2:** To learn about Bioinorganic Chemistry and Organometallic Chemistry **CO-3:** To know about the catalytic role of organometallic compounds in different types of industrial processes. **CO-4:** To study experimentally the qualitative detection of known and unknown radicals and insoluble materials in a mixture.
	CC-14	**CO-1:** To learn in detail about molecular spectroscopy. **CO-2:** To understand about the basic principles and laws of Photochemistry and also get idea about the theory of reaction rate. **CO-3:** To know details about surface energy and surface tension; Classification, Adsorption Isotherms and applications of Adsorption; Classification, rules and properties of Colloids. **CO-4:** To learn about the fundamental concepts, important equations, properties and applications of polarizability and dipole moment. **CO-5:** To know how to determine surface tension of a liquid; Indicator constant of an acid base indicator; pH of an unknown buffer solution and CMC of a micelle experimentally. **CO-6:** To study the kinetics of $K_2S_2O_8$ + KI reaction and Verification of Beer and Lambert's Law for $KMnO_4$ and $K_2Cr_2O_7$ solution experimentally.
	DSE	**A-3. GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS** **CO-1:** To learn about green chemistry and its necessity. **CO-2:** To study about the principles of green chemistry and designing the green synthetic routes. **CO-3:** To know about the examples of green reactions and future trends in green reaction. **CO-4:** To learn the synthesis, psychological properties, isolation medicinal

		importance and other synthetic use of terpenes and alkaloids **CO-5:** To learn how to perform green synthesis of a number of organic compounds in the laboratory. **A-4. ANALYTICAL METHODS IN CHEMISTRY** **CO-1:** To study the fundamental laws of spectroscopy and Selection rules, to know the basic principles of Instrumentation for UV-visible spectroscopy and Infra-red spectroscopy and their use for the determination of composition of inorganic complexes, estimation of metal ions in aqueous solution, quantitative analysis of geometrical isomers and keto-enol tautomerism. **CO-2:** To learn in detail about the Flame Atomic Absorption and Emission Spectrometry and its application. **CO-3:** To know the basic concepts of thermogravimetry and quantitative estimation of Ca and Mg from their mixture, to learn about the electroanalytical methods and their applications for the determination of equivalence point and pKa values. **CO-4:** To learn experimentally about different types of separation techniques such as Solvent extraction technique and Chromatography technique. **CO-5:** To learn the methods of separation of stereoisomers, calculation of enantiomeric and diastereomeric excess ratios and determination enantiomeric composition by spectral, chemical and chromatographic data analysis. **CO-6:** To study experimentally how to separate a mixture of monosaccharides, a mixture of dyes and active ingredients of plants, flowers and juices by chromatography method. **CO-7:** To learn experimentally how to separate a mixture of ions by solvent extraction technique; determination of pH of soil and estimation of Ca, Mg and phosphate ion in soil. **CO-8:** To determine the pKa values, COD and BOD by Spectrophotometry method in presence of a indicator. **B-3. POLYMER CHEMISTRY** **CO-1:**To learn about the history, classification and functionality of polymeric materials. **CO-2:** To know about the kinetics of polymerization, details on crystallization and morphology of crystalline polymers, determination of crystalline melting point of a crystalline material and the factors effecting crystalline melting point. **CO-3:**To understand the nature and structure of polymers, determination of molecular weight of polymers and thermodynamics of polymer solution. **CO-4:**To study the preparation, structure, properties and application of different types of addition and condensation polymers. **CO-5:** To know how to prepare polymers by using free radical polymerization, redox polymerization, interfacial polymerization, precipitation polymerization, addition polymerization and condensation polymerization process. **CO-6:** To learn experimentally how to characterize and analyze a polymeric compound or material. **B-4. DISSERTATION** **CO-1:** To know how to do research work and write a review rticle on a particular field/topic as assigned by the teacher

		CO-2: To know how to handle the technical devices for presenting research works.

Program Outcomes

PO-1: Disciplinary knowledge and skill: A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical knowledge in all disciplines of Chemistry. Students can solve their subjective problems very methodically, independently and finally draw a logical conclusion. Further, the student will be capable of applying modern technologies, handling advanced instruments and Chemistry related soft-wares for chemical analysis, characterization of materials and in separation technology.

PO-2: Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

PO-3: Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking and to design, carry out, record and analyze the results of chemical reactions. Students will be able to think and apply evidence based comparative chemistry approach to explain chemical synthesis and analysis.

PO-4: Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

PO-5: Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.

PO-6: Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

PO-7: Digitally literate: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, use of chemical simulation software and related computational work.

PO-8: Ethical awareness: A graduate student requires understanding and developing ethical awareness or reasoning which is adequately provided through the course curriculum. Students

can also create an awareness of the impact of chemistry on the environment, society, and also make development outside the scientific community.

PO-9: Environmental Awareness: As an inhabitant of this green planet a Chemistry graduate student should have many social responsibilities. The course curriculum is designed to teach a Chemistry graduate student to follow the green routes for the synthesis of chemical compounds and also find out new greener routes for sustainable development. The course also helps them to understand the causes of environmental pollution and thereby applying environmental friendly policies instead of environmentally hazard ones in every aspect.

PO-10: **Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available e-techniques, e-books and e-journals for personal academic growth.

PO-11: Analytical skill development and job opportunity: The course curriculum is designed in such a way that Chemistry graduate students can handle many Chemistry based software, decent instruments and advanced technologies to synthesize, characterize and analyze the chemical compounds very skillfully. Such a wonderful practice in the graduate level will bring a good opportunity to the students for getting job in industries besides academic and administrative works.

Programme Specific Outcomes

PSO-1: Core competency: The chemistry graduates are expected to gain knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical. These fundamental concepts would be reflected in the latest understanding of the field to keep continues its progression.

PSO-2: Communication skills: Chemistry graduates are expected to possess minimum standards of communication skills to read and understand documents so that they can solve their problems very methodically, independently and with logical argument. Graduates are expected to build good communication skill so that they can easily share their idea/finding/concepts to others.

PSO-3: Critical thinking: Chemistry graduates are expected to achieve critical thinking ability to design, carry out, record and analyze the results of chemical reactions. They can have that much potential and confidence that they can overcome many difficulties with the help of their sharp scientific knowledge and logical approaches.

PSO-4: Psychological skills: Chemistry graduates are expected to possess basic psychological skills so that they can deal with individuals and students of various socio-cultural, economic and educational levels. Psychological skills are very important for proper mind setting during

performing, observing and giving conclusion of a particular reaction. It is also important for self-compassion, self-reflection, interpersonal relationships, and emotional management.

PSO-5: Problem-solving: Graduates are expected to be well trained with problem-solving philosophical approaches that are pertinent across the disciplines.

PSO-6: Analytical skill development and job opportunity: Chemistry graduates are expected to possess sufficient knowledge how to synthesize a chemical compound and perform necessary characterization and analysis in support of the formation of the product by using modern analytical tools and advanced technologies. Because of this course curriculum chemistry graduates have lot of opportunity to get job not only in academic and administrative field but also in industry.

PSO-7: Research motivation: Chemistry graduates are expected to be technically well trained with modern devices and Chemistry based software and has powerful knowledge in different disciplines of Chemistry so they can easily involve themselves in theory and laboratory-based research activities.

PSO-8: Teamwork: Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.

PSO-9: Digital Literacy: Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning.

PSO-10: Social Awareness: As an inhabitant of this green world it is our duty to make our planet clean and suitable for living to all. In this context Chemistry graduates are expected to be more aware about finding green chemical reaction routes for sustainable development. They are expected to maintain good laboratory practices and safety.

Course Outcomes of Chemistry Generic Elective

[For students having Honours in subjects other than Chemistry]

Semester	Course Code	Course Outcome
		CO-1: To know in detail about Kinetic Theory of Gases; Liquids and Chemical kinetics **CO-2:** To learn the basic concept, terms and equations of Atomic Structure; Chemical Periodicity and Acids and Bases **CO-3:** To learn about the Fundamentals of Organic Chemistry; Stereochemistry;

SEM-1	**CC-1/GE-1**	Types, Mechanism and Examples of Nucleophilic Substitution Reaction and Elimination Reaction **CO-4:** To learn practically how to do the quantitative estimation of ions in a solution by using iodometric titration, permanganate titration and dichromate titration. **CO-5:** To learn how to estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture and how to estimate of water of crystallization in Mohr's salt by titrating with $KMnO_4$. **CO-6:** To study the estimation of oxalic acid by titrating it with $KMnO_4$.
SEM-2	**CC-2/GE-2**	**CO-1:** To understand detail about Chemical thermodynamics, Chemical equilibrium, Solutions, Phase Equilibrium and Solids. **CO-2:** To learn about synthesis, properties and reactions of Aliphatic Hydrocarbons **CO-3:** To understand about Error analysis and Computer Aplications **CO-4:** To know the basic knowledge, types and applications Redox Reactions **CO-5:** To study the kinetics of acid-catalyzed hydrolysis of methyl acetate and decomposition of H_2O_2 (Clock Reaction) **CO-6:** To determine the viscosity of unknown liquid (glycerol, sugar) with respect to water surface tension of a liquid using Stalagmometer and the solubility of sparingly soluble salt in water **CO-7:** Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method.
SEM-3	**CC-3/GE-3**	**CO-1:** To learn about Chemical bonding and Molecular structure, Comparative study of p-block elements, Transition Elements and Co-ordination Chemistry **CO-2:** To know the basic concept, terms, equations and applications of Electrochemistry **CO-3:** To understand about the synthesis, properties, chemical reactions and mechanisms of Aromatic Hydrocarbons, Organometallic Compounds and Aryl Halides **CO-4:** To study experimentally the qualitative detection of known and unknown radicals in a mixture
SEM-4	**CC-1/GE-4**	**CO-1:** To learn in detail about the preparation, properties, chemical reactions and mechanisms of Alcohol, Phenol, Ethers, Aldehydes, Ketones, Carboxylic acids, Esters, Amides, Amines, Diazonium salts, Amino-acids and Carbohydrates. **CO-2:** To know in detail about Crystal Field Theory. **CO-3:** To study the fundamental concepts of Quantum Chemistery and Spectroscopy. **CO-4:** To learn experimentally the qualitative analysis of single known and unknown solid organic compounds and also the identification of pure solid and liquid organic compounds.