New York City College of Technology  
Department of Chemistry  

Course Code: CHEM 3622  
Title: Inorganic Chemistry  
Number of hours, credits: (4 credits, 3 hours lecture, 3 hours lab)  

Course Description:  
This course covers in a comprehensive way the fundamental concepts of inorganic chemistry. It deals with the properties of all the elements in the periodic table, ranging from highly reactive metals to noble metals and non-metals. Students taking this course gain clear insights into essential concepts such as bonding theory, molecular orbitals, group theory, coordination chemistry, organometallic chemistry and bioinorganic chemistry, among others. In addition, the course is accompanied by a laboratory to properly settle the concepts learned during the lectures.  

Pre-requisites: CHEM1210  
Co-Requisite: CHEM 3622/L  

Course Attributes: Writing Intensive  


Course Specific Student Learning Outcomes.  

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<tr>
<th>LEARNING OUTCOMES</th>
<th>ASSESSMENT</th>
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<tr>
<td>For successful completion of the course, students should be able to:</td>
<td>Evaluation methods and criteria</td>
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<tr>
<td>Describe the atomic structure and use the periodic table to find trends and explain properties of elements</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Use symmetry and group theory to predict vibrational spectra</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Describe bonding in terms of molecular orbitals</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Explain coordination complexes and their bonding/geometries using the ligand field theory.</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Understand the reactivity of coordination complexes</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Describe basic elements of organometallic chemistry, bioinorganic chemistry and environmental</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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General Education Learning Outcomes.

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<td>For successful completion of the course, students should be able to:</td>
<td>Evaluation methods and criteria</td>
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<td>Understand and employ both quantitative and qualitative analysis to describe and solve problems</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Employ scientific reasoning and logical thinking</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Communicate effectively using both written and oral means</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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<td>Demonstrate intellectual honesty and personal responsibility</td>
<td>Lecture/Lab participation, group work, assignments, examinations, homework</td>
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Assessment:

Evaluation Methods and Criteria:

Students will evidence their knowledge through homework assignments, exams, laboratory exercises, and laboratory reports. The final grade will be based on a weighted average of the grades achieved on tests, homework, and laboratory performance. As follows:

- Three exams 45%
- Research Project 15%
- Final exam 15%
- Laboratory work and reports 25%
Course Outline:

Lectures: 3 hours/week

**Week 1:** Introduction to inorganic chemistry.
**Week 2:** Review of basic concepts of atomic theory, periodic trends, and simple bonding theories.
**Week 3:** Symmetry and group theory.
**Week 4:** Applications of group theory to vibrational spectroscopy.
**Week 5:** Molecular orbitals: general principles.
**Week 6:** Molecular orbitals of homonuclear diatomic molecules.
**Week 7:** Molecular orbitals of heteronuclear diatomic molecules and larger molecules.
**Week 8:** Frontier orbitals and acid-base behavior. Hydrogen bonding. Hard-soft acid-base interactions.
**Week 9:** Coordination chemistry. Nomenclature, isomerism, coordination numbers and geometries.
**Week 10:** Electronic structure of coordination complexes. Ligand field theory.
**Week 11:** Reactions and mechanisms of reactions of coordination complexes.
**Week 12:** Elements of organometallic chemistry.
**Week 13:** Catalysis.
**Week 14:** Essentials of bioinorganic chemistry
**Week 15:** Review for final exam and administration of final exam

Laboratory work: 3 hours/week

Experiment 1: Safety, Orientation, and Check-in
Experiment 2: Solid state chemistry: synthesis of a zeolite
Experiment 3: Synthesis of a zeolite (cont.)
Experiment 4: Synthesis of PdCl₂(NCPh)₂. FTIR spectrum and group theory analysis
Experiment 5: Exercises in VSEPR/MO theory
Experiment 6: Synthesis of cis-diaminedichloroplatinum(II) (cisplatin)
Experiment 7: Interaction of cisplatin with DNA (Circular Dichroism)
Experiment 8: Measurements of magnetic susceptibilities using a magnetic balance and Evan's NMR method.
Experiment 9: Electronic spectra of transition metal ions. Interpretation using Tanabe-Sugano diagrams
Experiment 10: Synthesis and FTIR spectrum of RuHCl(CO)(PPh₃)₃
Experiment 11: Synthesis and FTIR spectrum of [RuH(CO)(NCCH₃)₂(PPh₃)₂]PF₆
Experiment 12: ¹H and ³¹P NMR spectra of RuHCl(CO)(PPh₃)₃ and [RuH(CO)(NCCH₃)₂(PPh₃)₂]PF₆
Experiment 14: Research Project Presentations
Experiment 15: Check-out and Lab Exam
Academic Integrity Policy Statement

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on Academic Integrity may be found in the catalog.

Technology Statement

Before entering the course, students must be familiar with MS Word, MS Excel (simple spreadsheet calculations and graphing), and power point. During this course, students will learn how to convert between different data file types and how to import text file data into graphing software. Students will also learn how to perform simple computational chemistry calculations using commercially available software.

Date of most recent revision of this document: 8/2016 (AMartinez); 4/2017 (DSamaroo)