University of Puerto Rico
Río Piedras Campus
Faculty of Natural Science
Chemistry Department
Undergraduate Program

Title: Introduction to Inorganic Chemistry: The Different Perspectives of Bonding
Course: Chemistry 4000-0U1
Credits: 3
Pre-requisite: Chemistry 3452
Hours: Tuesday/Thursday, 10:00-11:20 am, CN A-233
Professor: Arthur D. Tinoco, FB-312, arthur.tinoco@upr.edu
Office Hours: Tuesday/Thursday, 1:00-3:00 pm, or can request a meeting outside of those hours
Website: http://uprrpinorganicchemistry.weebly.com/

Course Description: Students will learn the fundamentals of what composes an atom and how atoms engage in bonding. They will be exposed to a survey of periodic trends that will broaden their perspective of elements. Group theory and symmetry concepts will be introduced to better understand molecular spectroscopic properties and bonding. The course will also encompass topics on coordination chemistry, including nomenclature, isometry, bonding theories, spectroscopy, and stability/lability.

Contingency Plan in case of an Emergency: In case of an emergency or interruption of classes, your professor will communicate via institutional email to coordinate the continuity of the course offering. If there is any interruption of the classes during the semester, they will continue to be offered using the remote or online modality to comply with the syllabus.

Objectives: Defined in the table below specifying the time dedicated to each topic and the dates on which the topics will be covered.

Date	Topic	Assignment Due
Jan. 18	Course Introduction	
Jan. 23	Chapter 1: The Atom	
Jan. 25	Chapter 1: Electrons in an atom	
Jan. 30	Chapter 2: Bonding Theories-Lewis Structures and VSEPR	
Feb. 1	Chapter 2: Valence Bond Theory and Molecular Orbital Theory to explain diatomic molecules	
Feb. 6	Chapter 3: Introduction to Group Theory	HW Set 1: Ch. 1 and 2
Feb. 8	Chapter 3: Continuation of Group Theory	
Feb. 13	Chapter 3: Point Groups and Character Tables	
Feb. 15	Chapter 3: Using group theory to predict molecular and spectroscopic properties Chapter 4.6: Infrared and Raman spectroscopies	
Feb. 16	**Exam 1 (Ch. 1 and 2)**	
Feb. 20	Chapter 5: Valence Bond Theory and Hybrid Orbitals	
Feb. 22	Chapter 5: Molecular Orbital Theory and Polyatomic Molecules **Project Assignment Discussion**	

Feb. 27	Chapter 5: Molecular Orbital Theory and Polyatomic Molecules- Continuation	
Feb. 29	Chapter 6: Solid State Structures	**Project Assignment Group Selection** HW Set 2: Ch. 3 and 5
Mar. 5	Chapter 6: The Lattice Energy, Defects in Solid State Lattices, and Conductivity	
Mar. 7	Chapter 7: Solubility and Acid-Base Theories And Chapter 9.4	
Mar. 8	**Exam 2 (Ch. 3 and 5)**	
Mar. 12	Receso	
Mar. 14	Chapter 7 and Chapter 9.4 Part 2: Continuation of Acid-Base Theories and Introduction to Coordination Chemistry	
Mar. 19	Chapter 7: Nomenclature and the thermodynamics of Coordination Chemistry	
Mar. 21	Chapter 19: Isomerism	
Mar. 26	Chapter 19: Coordination Number Chapter 20: Bonding theories to explain Coordination Compounds A	
Apr. 2	Chapter 20: Bonding theories to explain Coordination Compounds B	HW Set 3: Ch. 6, 7, and 19
Apr. 4	Chapter 20: Bonding theories to explain Coordination Compounds C	
Apr. 5	**Exam 3 (Ch. 6, 7, and 19)**	
Apr. 9	Chapter 20: Understanding the Absorption Electronic Spectra of Coordination Compounds A	
Apr. 11	Chapter 20: Understanding the Absorption Electronic Spectra of Coordination Compounds B	
April 12	**Guest Lecturer-** Dr. Eszter Boros, University of Wisconsin-Madison (RISE Seminar Series)	**Project Assignment-Manuscript Complete Draft**
Apr. 16	Chapter 20: Understanding the Absorption Electronic Spectra of Coordination Compounds C	
Apr. 18	Chapter 20: Magnetic Properties of Coordination Compounds	
Apr. 23	Chapter 26: Ligand Substitution Reactions	
Apr. 25	Chapter 26: Ligand Substitution Reactions and Electron-transfer Processes	
Apr. 26	**Project Assignment-Manuscript Final Draft**	
Apr. 30	Chapter 26: Electron-transfer Processes (continuation)	
May 1	**Project Assignment-Group Presentations**	
May 2	Review	HW Set 4: Ch. 20, 26
May 6	**Exam 4 (Ch. 20 and 26)**	

Textbook: Inorganic Chemistry Fifth Edition
By: Catherine E. Housecroft and Alan G. Sharpe

Instruction Techniques: This course is designed with an emphasis on a student-teacher interactive pedagogy. Students are expected to ask questions and to engage in discussions in class. The most current information for the course can be obtained from the class website. You will find there a copy of this syllabus, announcements, homework keys, exam keys, class PowerPoint slides, and supplemental information. Every lecture will be delivered in a synchronous manner. Feel free to contact me at arthur.tinoco@upr.edu if you have a question.

Alternative Methods of Teaching: Certification Number 112 (2014-14) of the Board of Governors defines a presential course as one in which 75% or more of the hours of instruction require the physical presence of the student and the professor in the classroom. This means that 25% of a presential course may be offered without the physical presence of the students and professor in the classroom. In case it is necessary, these courses could complete up to 25% of the contact hours (11.25 hours) in a non-presential way by using alternative methods of teaching, such as: Video-conferences, instructional modules, discussion forums and cyberlectures, among others. If this is the case, the calendar/program will be modified to include which topics will be covered by alternative methods.

Requirements:
1. Calculator- For all homework assignments and exams.
2. Laptops- To access software and online databases pertinent to the completion of mini-assignments and the semester team paper assignments.

Grading System:
Short Assignments and Participation. Homework assignments will be posted on the website but will not be graded. You will also receive short-assignments/quizzes throughout the semester that will be evaluated. Your participation in course-related discussions and being interactive with questions during class will enhance your performance. (10%)

Paper Assignment. This semester we will all participate in a Special Project that will bring research into the classroom. We will prepare a review article on an important topic that the field of Inorganic Chemistry is contributing to. To tackle this review article, we will divide into groups of 5-6 students to address a particular subtopic. Each group will write a manuscript focused on this subtopic and also engage in an in-class presentation where you will elaborate on the highlights of the pertinent research accomplishments. The purpose of this assignment is to expose you to journal search engines and to scientific writing in the form of research articles and to critically examine results to craft your own assessment of the work. A full discussion of the assignment will occur during a class lecture. (20%)

Exams. Four exams will be given in class on the dates listed. (70%)

Grading Summary. Listed below is the overall breakdown of the grading scheme for the course. I will use the numerical score obtained using this scheme to guide me in assigning your final grade of A, B, C, D, or F. Your exact final grade will be assigned based on my evaluation of your understanding of the subject material. I will be most happy to discuss your standing in the class at any time.

Short Assignments/Participation: 10%
Paper and Presentation: 20%
Exams (4): 70%

Academic Integrity: I strongly believe in the integrity of an academic honor code. This is a code of honesty that all work submitted is produced solely by the student who is submitting. The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not

limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.

Policy and procedure for handling sex or gender discrimination situations at the University of Puerto Rico: The University of Puerto Rico (University), as an educational institution and workplace, aims to protect the rights and offer a safe environment for all individuals who interact with the institution, whether they are students, employees, contractors, and/or visitors (hereinafter "concerned persons"). In light of this, the present Policy is enacted by virtue of Certification 107, JG 2021-2022, with the goal of promoting an environment of respect for diversity and the rights of the members of the university community. The protocol is established for handling situations related to the following prohibited behaviors: discrimination on the basis of sex, gender, or pregnancy, sexual harassment, sexual violence, domestic violence, dating violence, and stalking (hereinafter, "the prohibited behaviors"), in the work and study environment.

Reasonable accommodation: The University of Puerto Rico complies with all state and federal laws as wells as rules concerning discrimination, including “The American Disabilities Act” and Law #51 of the Commonwealth of Puerto Rico. Every student with a disability has the right to apply for and receive reasonable accommodation and Vocational Rehabilitation services. Students with special needs that require some type of assistance or reasonable accommodation because of a disability or who receive services from the Office of Vocational Rehabilitation should speak to the professor at the start of the semester to plan the accommodation and assistive equipment needed according to the recommendations of Office of Services to Students with Disabilities (OSEI in Spanish), Dean of Students Office. Differentiated evaluation will be done in cases of students with special needs. Receiving reasonable accommodation does not exempt students from meeting the requirements, responsibilities, and academic rigor of the course.

Make-up Policy: Notify me as soon as possible if you are unable to take an exam because of illness or other extraordinary circumstances.

Bibliography: For additional information please refer to any research articles cited during lectures. Also the following textbooks are very helpful.

James E. Huheey, Ellen A. Keiter, and Richard L. Keiter. *Inorganic Chemistry.* 4th Edition.

Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr. *Inorganic Chemistry.* 5th Edition.

F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Murillo, and Manfred Bochmann. *Advanced Inorganic Chemistry.* 6th Edition.

Bertini, I., Gray, H.B., Stieful, E.I., Valentine, J.S. *Biological Inorganic Chemistry: Structure & Reactivity*.