

## CHEMISTRY 251: INORGANIC CHEMISTRY I

### COURSE SYLLABUS AND DESCRIPTION

Dr. Rajaseelan

Spring 2026

CAP-213; Ext. 7395

Office Hours: M: 11:00 am-12:50 pm; T: 10:00 – 11:50 am; W: 8:00-8:50 am

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This is the first course in inorganic chemistry with emphasis on the unification of descriptive chemistry with the basic principles that may be used to explain natural phenomena in inorganic chemistry. The physical and chemical properties of the elements and important classes of compounds will be described and explained. Acid-base and oxidation-reduction behavior will be emphasized along with coordination chemistry and bio-inorganic chemistry. Periodic trends are an integral part of the course. Pre- or co-requisite: CHEM 112.

Together with CHEM 452, this course meets the most recent ACS guidelines, which recommend a full year of inorganic chemistry in the undergraduate curriculum for students whose professional goal is to be a chemist (CHBS). It is also the recommended inorganic chemistry course for students in the BA, BSED, or BS (Biochemistry) degree programs.

#### TEXTS:

Descriptive Inorganic Chemistry, Geoff Rayner-Canham & Tina Overton; sixth edition. (W.H. Freeman and Company, 2014)

There are many basic inorganic chemistry books in the library.

#### COURSE REQUIREMENTS AND POLICIES:

**Regular attendance is required.**

Problems will be assigned in each class period.

Regular quizzes will be given mostly on Fridays. In addition, three midterm exams will be scheduled, and the final exam will be comprehensive.

All students will take the exams and quizzes as scheduled. Other than health problems (**that require a signed excuse from a doctor**), excused absences will only be considered **before** the scheduled exam. A make-up exam will be scheduled at a mutually agreeable time within **two** days in these circumstances. There are no make-up quizzes. **With a valid excuse** the percentage in the final exam will be used to calculate the grade for the missed quiz.

<b>CHAPTER</b>	<b>TOPIC</b>
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- |    |   |
|----|---|
| 1. | The Electronic Structure of the Atom.       |
| 2. | The Structure of the Periodic Table         |
| 3. | Covalent Bonding and Molecular Spectroscopy |
| 4. | Metallic Bonding and Alloys                 |

**EXAM I (Chapters 1-4)**

- |     |  |
|-----|--|
| 5.  | Ionic Bonding and Solid-State Structures |
| 19. | Transition Metal Complexes               |

**EXAM II (Chapters 5 & 19)**

- |         |   |
|---------|---|
| 20, 21. | 3d, 4d, 5d Transition Metals                                    |
| 22.     | Group 12 Elements   |
| 24.     | The Rare Earth and Actinide Elements<br>Bio Inorganic Chemistry |

**EXAM III (Chapters 20,21,22,24 & Bioinorganic)**

- |       |   |
|-------|---|
| 6.    | Inorganic Thermodynamics                |
| 7.    | Solvent Systems and Acid base Behavior. |
| 8.    | Oxidation and Reduction                 |
| 10-17 | The Main Group Elements                 |

**EXAM IV (Chapters 6-8)**

**FINAL EXAM(COMPREHENSIVE): THURSDAY MAY 08, 8 - 10 am.**

**GRADING SYSTEM:**

4 Mid-term Exams	400 pts
Quizzes	200 pts
Final Exam	<u>200</u> pts
Total	800 pts

<u>Letter Grade</u>	<u>Percentage</u>	<u>Letter Grade</u>	<u>Percentage</u>
A	90 - 100%	C	70 - 74%
A-	87 - 90%	C-	67 - 70%
B+	84 - 87%	D+	64 - 67%
B	80 - 84%	D	60 - 64%
B-	77 - 80%	D-	57 - 60%
C+	74 - 77%	F	below 57%

**COURSE LEARNING OBJECTIVES:**

Upon completion of Chemistry 251, you should be able to...

Draw radial density distribution function of orbitals, predicting possible and favored oxidation states of elements, writing quantum numbers, and electron configurations of elements, ions and especially that of transition metal ions.

Predict general trends in size of atoms and ions, 1<sup>st</sup> and successive ionization energies, electron affinities, magnetic properties, and physical properties of elements.

Draw Molecular orbital diagrams of homonuclear diatomic molecules and predict bond orders and magnetic properties. Using VSEPR theory you should be able to predict, electron pair and molecular geometries, hybridization, polarity, and Lewis structures and should be able to calculate formal charges, formal oxidation states and bond orders.

Using band theory, Explain the difference between a conductor, different types of semi-conductors, and insulators, know the different types of packing among metals, and calculate the number of structural units per unit cell. Know the different types of alloys.

Identify the factors affecting the polarization of ionic bonds, know the different types of ionic lattices and find the coordination numbers, empirical formula from a crystal lattice.

Name coordination compounds, draw and identify the types of isomers, and using the crystal field theory to draw the splitting of d orbitals of different geometries, identify weak/strong field ligands, and low/high spin complexes.

Identify and know general and interesting properties and chemistry of d block elements and their compounds, f-block elements, and important industrial and biological applications of these elements and compounds.

Balance redox reactions by electron transfer methods, draw and determine potentials from Latimer Diagrams, Frost Diagrams, Pourbaix diagrams, and Ellingham Diagrams.

Construct Born-Haber cycles of ionic and covalent compounds, know examples of hot/cold packs, and whether these reactions are enthalpy/entropy driven.

### **CHEMISTRY PEER LEARNING HOURS (Caputo 211)**

- Tues. 4:00 – 6:00 pm
- Wed. 4:00 – 6:00 pm
- Thur. 4:00 – 6:00 pm

*Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University's Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy incidents of sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred. Information regarding the reporting of sexual violence, and the resources that are available to victims of sexual violence, is available at <http://www.millersville.edu/socialeq/title-ix-sexual-misconduct/index.php>.*