Course Instructor: Andreas Mayr
Office: Chemistry 721; Office Hours: Tu/Th 1:00-2:00 p.m.
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Lectures: Tu/Th 11:30 a.m. – 12:50 p.m.

Room: Heavy Engineering 201

Exams and Quizzes: Three midterm examinations (100 points each) and a final exam (200 points); in-class quizzes and presentations (optional points); homework assignments (100 points). There will be no make-up examinations. Absence from one midterm exam may be excused based on a written request with documentation.

Midterm examination dates: September 25, October 23, and November 20.
The date and time for the final examination is published in the University Final Exam Schedule.

Recommended textbook: Miessler, Tarr, Inorganic Chemistry, Prentice Hall
Other suitable textbooks:
  House, Inorganic Chemistry, Elsevier
  Housecroft, Sharpe, Inorganic Chemistry, Pearson
  Shriver, Atkins, Inorganic Chemistry, Freeman
  You may also consult online resources such as Inorganic Chemistry on Wikipedia
The aim of the course is to enhance our understanding of the fundamental principles of chemistry based on qualitative theoretical models for atoms, molecules and solid materials, and to explore the diverse chemistry of all elements. At the end of the course we will be able to read and understand articles in the popular and scientific literature concerning inorganic chemistry. The acquired skills will also help us to better understand basic aspects of other areas of applied chemistry such as materials chemistry, organic chemistry, and biochemistry. Thus we will acquire a firm basis to participate in chemistry-related discussions. These general goals will be achieved by pursuing learning outcomes which may be tested in examinations: We will strive to gain a solid understanding of the material covered in the course topics and to acquire the ability to apply this knowledge to new situations. These specific learning goals will be aligned with the course topics listed below.

Course Structure: We will cover the course topics in parallel thematic tracks: In one track we will focus on fundamental theories and principles, in another we will explore general chemical aspects and practical applications. In the fundamental track we will begin with an overview of periodic trends, introduce the language of symmetry, discuss the electronic structure of atoms and molecules and introduce the basic principles of solid-state structures. In the practical track we will first introduce the elements, then cover a broad range of fundamental and practical aspects of the chemistry of the elements, and finally focus on selected advanced topics. At this stage we will be able to merge the fundamental and practical aspects, for example in discussions of metals and semiconductors (including solar cells and light-emitting diodes), and transition metal catalysis.

The course is organized as a series of lectures. All of the fundamental material, which is covered by the recommended textbook, will be presented on chalkboard, and you will have to write your own notes. Additional material will be posted on Blackboard: relevant reviews from the literature, articles form the chemical press (Chemical and Engineering News of the American Chemical Society), and articles from magazines and newspapers. While the class is a lecture course, it should feel like a conversation about chemistry. Your participation will be actively encouraged at all levels. This will include very brief in-class presentations on relevant topics.

There will be weekly problem sets as homework. These will be posted one week before the due date, so that there is always one class available for feedback on individual questions. (A different schedule may be followed ahead of examinations.) On the due date the homework will be collected at the beginning of class.
Course Topics:

**Fundamental Theories and Principles**
- Molecular symmetry
- Electronic structure of atoms and atomic ions
  - Electron affinity, ionization energy, magnetism
- Molecular orbitals of diatomics
- Molecular structure – Lewis structures
- Molecular geometry – VSEPR
- Hybrid orbitals
- Molecular orbital theory (Linear combination of atomic orbitals)
- Structure of solids
  - Covalent structures, structures of metals, ionic structures
- Intermolecular interactions

**Basic Aspects of the Chemistry of the Elements**
- Chemistry of the main group elements
  - Element groups: Hydrogen, water, hydrogen economy;
    alkali metals to noble gases
  - Element rows: First and second period versus heavier elements
- Chemistry of the transition metals
- Acid-base chemistry
- Oxidation-reduction chemistry

**Special Topics**
- Chemistry of materials
  - Insulators, metals, semiconductors, magnetic materials
  - Semiconductor devices (solar cells, light-emitting diodes)
- Transition metal catalysis