

Advanced Inorganic Chemistry
Fall 2026

Text: *Inorganic Chemistry*, 4th Ed. by J.E. Huheey, E.A. Keiter, and R.L. Keiter

Location: Lecture: Science 470, Pre-lab Science 470, Lab Science 414

Handouts: All available on-line @ <https://mupages.marshall.edu/sites/castellani/chemistry-448-course-page/#gsc.tab=0>

Lecture notes for all chapters

This syllabus and the lab syllabus

Homework assignments

A set of old tests & answer keys

Study suggestions

Course Description: Study of physical properties and periodic relationships of inorganic materials. 3 lec. – 4 lab. (PR: CHM 356 and either 357 or 358)

Instructor: Michael Castellani

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Lab: 407 Science Hall

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Learning Objectives: 1) to apply the principles of quantum mechanics learned in Physical Chemistry to chemical bonding, 2) to introduce the relationship between molecular structure and chemical reactivity, 3) to learn to determine molecular symmetry and to understand its effects on molecular properties and spectroscopy.

<u>Date</u>	<u>Subject</u> (all dates tentative)	<u>Chapter</u>
Week 1	Introduction, Atomic Structure	2
Week 2	Atomic Structure	2
Week 3	Symmetry	3
Week 4	Symmetry	3 (Test 1)
Week 5	The Ionic Bond: General Information	4
Week 6	The Ionic Bond: Theory	4
Week 7	The Covalent Bond: Valence Bond Theory	5
Week 8	The Covalent Bond: Molecular Orbital Theory	5
Week 9	Structure and Reactivity	6 (Test 2)
Week 10	Solid State Chemistry	7
Week 11	Chemical Forces	8
Week 12	Coordination Chemistry, Valence Bond Theory	11
Week 13	Crystal Field and Molecular Orbital Theories	11
Week 14	Boranes	Handout (Test 3)

Final Exam: Tuesday, Dec. 8 from 8:00 - 10:00 a.m.

Office hours: Monday 2:00 p.m. – 3:50 p.m, Science 408 (my office) or virtually.
I should also be available most Tuesday and Friday mornings and some Thursday mornings from 11:00 to noon.

Grading:	3 Tests x 20%	60%
	Laboratory	10%
	Elements assignment	5%
	1 Final exam	<u>25%</u>
		100%

Tests will cover Chapters 2 & 3, 4 – 6, and 7, 8 & 11, plus handouts as described below or assigned in class.

The grading scale for the three tests is A = 70%-100%, B = 55 – 69.9, C = 40 – 54.9, D = 30 – 39.9. The grading scale for the lab and paper is A = 90%, B = 80%, C = 70%, D = 60%. The final exam may have a different grading scale.

There are **no** make-up exams. Those students with excused absences must see me in advance if at all possible. Students requiring accommodation because of a disability must obtain appropriate documentation (from the HELP Center or Sandra Clements) and contact me sufficiently far in advance of a test that necessary accommodation can be made.

Grading for the laboratory portion of the class will be discussed during the first meeting of the lab (Aug. 27).

Midterm Grades

You will receive a midterm grade in this course. This grade will reflect your performance on the course requirements we have had up to this point in the class and is not a guarantee that you will receive the same grade as your final grade in the course. Be advised that you must complete all remaining requirements. Students wishing to improve their performance should contact me to discuss strategies to do so.

Handouts: There are 9 handouts available online.

Elements – You are responsible for knowing the method of isolation (except where told otherwise), physical and chemical properties, and reactions for each of the elements. You may find the remaining information interesting, but it won't be tested. These handouts will be tested as follows: (this is separate from the "elements assignment")
Test 1: Groups IA - IIIA, VIIIA Test 3: First transition series, Uranium
Test 2: Groups IVA - VIIA Final exam: All handouts

Periodic table – This handout contains two blank periodic tables. You will need to memorize the location of all elements in it. Use these tables to help you. Please note you are **not** responsible for the lanthanides, actinides, and new synthetic elements. You should know the symbol for each element and its name. You are **not** responsible for other information (except for the handouts as described above).

Particle-in-a-box – This handout will help clarify some of the discussion in Chapter 2.

Ion names – You will **not** be tested on this, but I may use these names in the lecture notes and in class. You may also see them in lab. Knowing them will help you.

Transition metal electron configurations – This handout goes into greater depth than do the Chapter 2 notes in explaining why the 4s electrons are filled before the 3d electrons, but are also emptied first.

Molecular structure – This handout supplements the text in Chapter 6 (pp. 233 – 237).

Boranes – This handout will touch on one of the more interesting series of inorganic compounds.

Elements Assignment

You will write a short paper up to 5 pages, double-spaced, 12 pt Times New Roman or 10 pt Arial font on two elements to be picked by you as described in class. Roughly half of the paper should be devoted to each element. It should have references using formatting from the [ACS Style guide](#). This should have multiple references from print media and should include original references. i.e. The paper should not simply be the expansion or synopsis of reviews. You may find the references online (e.g. Some journals publish online or have old issues online, but the reference should be to where it appears in print.) In some cases, popular media, e.g. newspapers, may be appropriate for a source.

You should select some property or application of each element that is interesting and discuss it. One of the “interesting” features may come from an elements handout. Part of your grade will come from the originality of your choice so going with something off the handout would hurt you in that category. The element could be part of a molecule, but the element itself would have to be central to the functioning of the molecule. For example, replacing the hydrogens on linear hydrocarbons with fluorine results in a molecule that can act as artificial blood. A person could discuss how and why the fluorine allows that to happen. Likewise, writing a page on why the atomic weight of carbon is 12.011 amu/atom, would not be a good choice.

The paper will be due on Thursday, September 25 as a Word document emailed to me by 5:00 p.m. unless there is a test that week. If there is, the due date will be Thursday, October 2.

You will also make an up-to-10-minute presentation in either a class or a lab period that will be determined later. In it you will present a short summary of both your elements to the class.

University Policies

By enrolling in this course, you agree to the University Policies. Please read the full text of each policy (listed below) by going to [MU Academic Affairs: University Policies](http://www.marshall.edu/academic-affairs/university-policies). (URL: <http://www.marshall.edu/academic-affairs/policies/>)

- Academic Dishonesty Policy
- Academic Dismissal Policy
- Academic Forgiveness Policy
- Academic Probation and Suspension Policy
- Affirmative Action Policy
- Dead Week Policy
- D/F Repeat Rule

- Excused Absence Policy for Undergraduates
- Inclement Weather Policy
- Sexual Harassment Policy
- Students with Disabilities (Policies and Procedures)
- University Computing Services Acceptable Use Policy

Campus Carry Policy

University Policy, UPGA-12 (Campus Carry Policy) derives its authority from West Virginia State law, including the Campus Self-defense Act (W. Va. Code § 18B-4-5b). It pertains to the exercise of Concealed Carry on Marshall University's campus, except in designated areas, by individuals with a valid permit to Conceal Carry.

Individuals who choose to Conceal Carry are responsible for knowing and understanding all applicable federal, state, and local laws and Marshall University Board of Governors Rules, University Policies, and Administrative Procedures. University Policy, UPGA-12 applies to areas of campus and buildings that are directly under the possession or control of Marshall University.

Concealed Handguns are not observable to others and must be holstered and concealed on the body of the permit holder or in a personal carrier, such as a backpack, purse, or other bag that remains under the exclusive and uninterrupted control of the permit holder. This includes wearing the personal carrier with a strap, carrying or holding the personal carrier, or setting the personal carrier next to or within your immediate reach at all times. If your participation in class activities impedes your ability to maintain constant control of your Handgun, please make alternate arrangements prior to coming to class.

Marshall University E-Mail Accounts

You must have and use your MU email account. Your personal email accounts will not be used for official communication with Marshall University programs and personnel. You may redirect your MU email to your own personal email account, but you must sign in to your MU account to do that. Marshall University uses Office 365 email. For more information, visit Marshall IT: Office 365
(URL <https://www.marshall.edu/it/office365/>)

Generative AI Use Policy

While generative AI has many costs and benefits, there is no assignment in this course where generative AI would have an appropriate use in assisting you in completing the assignment. For the most part this should be obvious. You cannot use the internet, much less AI, in taking tests or the final exam. It cannot be used to do the laboratory experiments. There may be temptation to have it help you with the two writing assignments, the elements assignment and 'the write a procedure for an experiment assignment in the lab.' In each case, you are welcome to use the internet to assist you in completing the assignment (e.g. finding examples), consistent with university academic honesty policies, but the work must be entirely your own. You may not use generative AI in any way that would violate the Student Code of Conduct (URL: <https://www.marshall.edu/student-conduct/>).

Technology and Technical Skill Requirements

- Students must be proficient in the use of computers, the Internet, browsers, Microsoft Office Word, and other common applications, including Marshall email.
- Adobe Acrobat Reader will be needed to read some files. This plug-in is available free. (URL: <https://get.adobe.com/reader/>)

- Students may be required to submit assignments as Microsoft Word documents (.docx), using the most recent Microsoft Office suite. Office 365 is available at no extra charge to students enrolled at MU. For information visit Marshall IT: Office 365 (URL: <https://www.marshall.edu/it/microsoft365/>).

Technology Assistance

If you have technical problems, please contact one or more of the following:

- For assistance with technology--including Outlook, Microsoft, Adobe, and devices—contact Marshall University Information Technology.