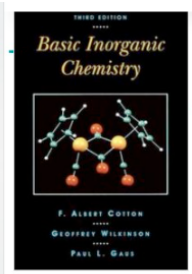
Descriptive Inorganic Chemistry
CHEMISTRY 362
Fall 2019

TEXT **Cotton, Wilkinson and Gaus "Basic Inorganic Chemistry,"**
Third edition Wiley & Sons, 1995 (ISBN: 978-0-471-50532-7)



This edition contains a new introductory section, a chapter on the organic solid state and three types of end-of-chapter exercises, one of which points students to professional literature. Important new material includes a better introduction to inorganic chemistry, improved treatment of atomic orbitals and properties such as electronegativity, new approaches to the depiction of ionic structures, nomenclature for transition metal compounds, quantitative approaches to acid base chemistry, expanded and unified treatment of the periodicity in structure and reactivity among the main group elements, Wade's rules for boranes and carboranes, the chemistry of new classes of substances such as fullerenes and silenes, and a new chapter on the inorganic solid state. Material on symmetry elements, operations and point groups has been put into an appendix.

ADDITIONAL REFERENCES
- Housecroft and Sharpe "Inorganic Chemistry" 3rd Edition, Pearson, Prentice Hall, 2008.
- Weller, Overton, Rourke "*Inorganic Chemistry*", W.H. Freeman and Company 7th Edition, (ISBN-10: 0-1987-6812-5 | ISBN-13: 978-0-1987-68128)
- Shriver & Atkins, 6th Edition, (ISBN-10: 1-4292-9906-1 ISBN-13: 978-1-4292-9906-0)

INSTRUCTOR Professor Kim R. Dunbar, RM 1224 Chemistry Building

ADMINISTRATIVE COORDINATOR: Courtney Stinnett, Phone 979.845.0057
Courtney.stinnett@chem.tamu.edu
Appointments with Prof. Dunbar will be made through Courtney

CLASS TIME TR 12:45-2:00 PM RM 255

OFFICE HOURS Professor Dunbar will be available Tues and Thurs 3:00 – 4:00 PM or by appointment.

TEACHING ASSISTANT Ellen Song songe@tamu.edu

This course begins with a review of basic bonding and structural concepts and then moves into descriptive chemistry of transition metal and main group elements. **Descriptive chemistry** is the term applied to the understanding of how compounds react with one another to form new compounds (much in the same manner as pure elements react to form compounds). It is a unified body of information resulting from periodic trends and fundamental chemical concepts and not a collection of unrelated facts and observations. Many students try to memorize everything rather than attempting to understand the underlying principles behind the reactions. With the exception of the periodic table, which everyone will be required to memorize, try to avoid mere memorization (although there is definitely some required memorization just as when one is learning vocabulary for a new language) but also identify the reasons why a reaction occurs in a particular manner. If you adopt this approach, you will be better equipped to predict when and how related compounds will react. *Bear in mind that the periodic table is the main tool of the inorganic chemist*. To make educated guesses about chemical reactivity one must understand some basic principles and then apply these principles to the compounds in question.

In this course, we first discuss numerous concepts – many of which you have already encountered – and then apply them to representative examples. Please study the appropriate sections of the text (and other chemistry books that you find helpful) *prior to the class session in which the material is discussed*. You must be prepared to invest time in this course in order to reap the benefits of a more than superficial comprehension. Reading the text, attending lectures and PLTL sessions and asking questions are essential for success in this course.

Examination questions cover topics that are discussed in lecture or are assigned for homework but will contain material that are extensions of these topics. Also, note that some of the topics covered in the text will be omitted from my lectures.

QUIZZES Six (6) 30 minute "Mini Exams" will be given the last 30 minutes of lectures on the days designated in the course outline or dates that will be announced in class if the schedule changes

HOMEWORK There will be eleven (11) homework assignments. You may omit one set without losing points. If all are completed, the lowest grade will be deleted.
Each homework set will be scaled to 25 points, for a maximum homework grade of 250 pts. **Note that only representative problems will be graded for some homework sets.**

COURSE POINTS	*Homework*	(10 @ 25 pts/each)	250 pts
	Mini-Exams	(6 exams @ 50 pts/each)	300 pts
	Final Examination		150 pts
	Paper		**100 pts**

	Total		800 pts

HOMEWORK **Problem assignments typically will be collected by at the beginning of class.**

Homework Due Dates:

Homework 1: Monday, September 9th
Homework 2: Tuesday September 24th
Homework 3: Tuesday October 8th
Homework 4: Tuesday October 15th
Homework 5: Tuesday October 22nd
Homework 6: Monday October 28th by 5 PM
Homework 7: Tuesday November 5th
Homework 8: Tuesday November 12th
Homework 9: Tuesday November 19th
Homework 10: Tuesday November 26th
Homework 11: Yuesday December 3rd

EXAMS **Six Mini-Exams will be given during the last 30 minutes of class on the designated dates.**

NOTE THAT THE FINAL EXAM is scheduled for Wednesday December 11, 2019 8:00 – 10:00 a.m.

PLTL WILL BE PART OF THIS COURSE
Peer-led team learning (**PLTL**) is a model of teaching undergraduate science, math, and engineering courses that introduces peer-led workshops as an integral part of a course. Students who have done well in a course are recruited to become *peer-leaders*. The peer-leaders meet with small groups of students each week to discuss, debate, and engage in problem solving related to the course material.
https://en.wikipedia.org/wiki/Peer-led_team_learning

PLTL Leaders:

Ella Mo	email: mo242@tamu.edu
Haley Naumann	email: hen294@tamu.edu
Hao Nguyen	email: paulhaonguyen@tamu.edu

PAPERS WILL BE COORDINATED BY THE PLTL ASSISTANTS
TOPICS WILL BE ANNOUNCED

GRADING SCHEME The course grading scale is indicated below

>85% A	≥65% C
≥75% B	≥55% D

Attendance and make-up policies: University rules are at outlined at http://student-rules.tamu.edu/rule07

ADA STATEMENT: Americans with Disabilities Act (ADA) Policy Statement
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu/

AGGIE HONOR CODE: "*An Aggie does not lie, cheat, or steal or tolerate those who* do."
For additional information please visit: http://aggiehonor.tamu.edu

TITLE IX AND STATEMENT ON LIMITS TO CONFIDENTIALITY
Texas A&M University and the College of Science are committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws provide guidance for achieving such an environment. Although class materials are generally considered confidential pursuant to student record policies and laws, University employees — including instructors — cannot maintain confidentiality when it conflicts with their responsibility to report certain issues that jeopardize the health and safety of our community. As the instructor, I must report (per Texas A&M System Regulation 08.01.01) the following information to other University offices if you share it with me, even if you do not want the disclosed information to be shared:

• Allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus.

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In many cases, it will be your decision whether or not you wish to speak with that individual. If you would like to talk about these events in a more confidential setting, you are encouraged to make an appointment with the Student Counseling Service (https://scs.tamu.edu/).
Students and faculty can report non-emergency behavior that causes them to be concerned at http://tellsomebody.tamu.edu.

CHEMISTRY 362, SPRING 2019
Descriptive Inorganic Chemistry

Lectures and Topics

A lecture outline is provided in the following pages which list the topics and appropriate pages numbers from the main textbook, Cotton, *et al*. Lectures will adhere to a schedule that is in accord with the pace of the class comprehension.

CLASS TIME: Tuesday and Thursday 12:45-2:00 PM CLASS LOCATION: RM 255

Week	Chapter: Pages	Topics
	1:3-25	Independent study and review, as appropriate.
1	1:3-25 2:35-63	**Preliminaries/Review** Quantization & quantum numbers: transitions; Atomic H-like orbitals. Many-Electron Atom; The *Aufbau* principle. Periodic Trends of Atoms: Electronegativity; Ionization Enthalpies; Atomic Radii.
2	3:73-120	**Structure and Bonding**
	3:73-98	Localized Electron-paired bonds: Lewis Structures; Formal charge, resonance. Molecular shape: Hybridization and VSEPR; Bond Lengths and Covalent radii; van der Waals Radii;
3 - 4	3:98-111	Delocalized Bonding: Molecular Orbital Theory Homonuclear diatomic molecules; Heteronuclear diatomic molecules
	Mini-Exam I	**30 Minute Mini-Exam on Topics in Chapters 1 and 2: September 12th**
4	3:111-120	**Polyatomic Molecules** M.O. Construction; Multicenter Bonding in Electron Deficient Molecules
5	4:125-142	**Ionic Solids** Crystal Lattices and Lattice energy; Born-Haber cycle; Geometries of Crystal Lattices; Structures of Ionic Solids Close Packing of spheres; Ionic Radii; Mixed Metal Oxides
5-6	5:147-162	**Chemistry of Selected Anions (this part will be brief)** Oxides, Hydroxides, and Alkoxides Non-Metal Polyoxoanions of N,P,S and Halogens; Transition Metal Polyoxoanions.
Mini-Exam II	**30 Minute Mini-Exam on Topics in Chapters 3: October 1st** **Fill out the periodic table for extra credit (20pts) – you will get 10 minutes for this part**	

Week	Chapter: Pages	Topics
6-7	6: 165-198 6: 199-211	**Coordination Chemistry** Coordination Number, Types of ligands; Isomerism in Coordination Compounds; Chiral complexes; Nomenclature; Stability and Reactivity of Coordination Compounds. Substitution Reactions; Electron – Transferred Reactions; Sterochemical Non- Rigidity
7-8	23:503-518	**Bonding in Coordination Complexes of the Transition Metals** Ligand Field and Crystal Field Theories. Molecular Orbital Approach for Octahedral Complexes. Correlation of Theory with Experiment. Magnetic Properties Other Geometries – Tetrahedral/Square Planar
	CHANGE Mini-Exam III	**30 Minute Mini-Exam on Topics in Chapters 4, 5 October 17th**
9	23:519-537	**Electronic Spectra of Atoms** Spectroscopic Terms: Ligand-field (d-d) Transitions. Charge Transfer Bands (Metal-to-ligand and ligand-to metal) Selection Rules and Intensities; Spectrochemical Series.
	Appendix I 785-791 804	Symmetry in Molecules; Symmetry Elements and Operations Determination of Point Groups WE WILL NOT COVER THIS AND IT WON'T BE ON AN EXAM
10	8:241-268	**The Periodic Table and the Chemistry of the Elements** The Nature and Types of Elements: Mono versus Polyatomic Molecules; Extended Structures. Periodic Trends and Chemistry of the Elements of the First Short Period. Elements of the Second Short Period Remainder of Non-Transition Elements. Elements of the d and f Blocks.
	9:273-283	**The Main Group Elements** Hydrogen. Bonding of Hydrogen; The Hydrogen Bond; Ice and Water Hydrates; Hydrides - Saline Hydrides; Metallic Hydrides Hydrogen as a Ligand.
	CHANGE Mini-Exam IV	**30 Minute Mini-Exam on Topics on Chapter 6: October 29th**

Week	Chapter: Pages	Topics
11	10: 287-302	**Group IA Elements**. Alkali metals
	11: 307-314	**Group IIA Elements**. Alkaline earth metals. Beryllium; Magnesium; Binary Compounds; Oxo Salts, Ions and Complexes; Summary of Trends.
	13: 357-365	**Group IIIB Elements** Al and Ga; In, TI, and Ga; summary of Trends
	14: 369-380	**Carbon Group** Diamond, Graphite, the Fullerenes and Carbides; Chemistry of Carbon with O, N S
	15: 383-392	**Group IVB** Si, Ge, Sn, Pb Multiple Bonding; Isolation and Properties; Hydrides; Chlorides; Complex Compounds; The Divalent State; Summary of Trends
		Mini-Exam V 30 Minute Mini-Exam over Topics in Chapters 23: Will cover everything in chapter 23 except spectroscopy and you don't have to know how to draw the full MO diagrams – just the bottom lone of the d orbital splittings November 14th
12	16: 399-412	**Nitrogen** Multiple Bonds; Hydrides; Oxides; Acids; Halides; Summary of Reactions.
	17: 417-428	**Group VB: P, As, Sb, Bi** The Elements; Hydrides; Halides; Oxohalides; Oxides; Sulfides; Oxo Acids. Complexes of Group VB Elements: P,N Compounds; Double Bonds; Summary of Trends.
	18: 435-447	**Oxygen** Occurrence, Properties and Allotropes; Ozone Ionic Oxides; Covalent or Molecular Oxides
13		**Chemistry of Oxygen Continued** Acid-Based Properties; Hydrogen Peroxide; Peroxides; Superoxides; Oxygen Compounds Ligands
	19: 451-461	**Group VIB: S, Se, Te, Po** Occurrence; Hydrides; Halides; Oxides; Acids.
	20: 465-478	**The Halogens: F, Cl, Br, I, At** Occurrence of the Elements; Halides; Oxides; Interhalogens; Organofluorine Compounds.
		Mini-Exam VI 30 Minute Mini-Exam on Topics we have covered up to the last lecture- to be announced: November 26th

Week	Topics
Week **14** (1 day)	**Tuesday November 26th (November 28th is Thanksgiving holiday)**
Week **15** (1 day)	**Tuesday December 3rd (last day of class - redefined Thursday class)**
	Forefront Topics in Inorganic Chemistry - to be announced

SPECIAL DATES FOR FALL 2019

December 5th Reading Day

FALL 2019 SEMESTER FINAL EXAMS: December 6th and December 9th -11th

FINAL EXAM: CHEM 362 is Wednesday, December 11th from 8:00 – 10:00 AM