Southern Connecticut State University
Department of Chemistry

Instructor: Dr. M. J. Gerald (Gerry) Lesley
Office: Jennings Hall 308
Telephone: (203) 392-6262 or ext: 26262 on campus
E-mail: Lesleym1@Southernct.edu

Title: CHE 532 - Advanced Inorganic Chemistry I

Prerequisite: CHE370-371

Lectures: TBA
Office Hours: TBA

Course Description: Presentation of the theoretical and descriptive aspects of the chemical elements given at an advanced level. Particular emphasis is placed on the theoretical cases for physical and chemical properties of the elements.

Course Objectives: To provide students with the necessary skills to enable them to:

1. Review current literature and issues within the field of inorganic chemistry. The primary purpose in this regard will be the development of a knowledge base in the field of study.
2. Understand the evolution and significance of historical developments in the field of study.
3. Acquire problem-solving skills and critical thinking in the field of study including the ability to rationalize the products obtained from inorganic reactions.
4. Demonstrate, through assignments based in rational thinking, an understanding of the basic themes underlying inorganic reactivity.
5. Prepare students for an advanced level of theoretical understanding of structure and bonding, and physical and chemical properties of inorganic compounds.

Course requirements: Students are expected to attend lectures to develop the necessary background required to evaluate literature sources and to demonstrate this understanding to the class and instructor by way of seminar presentations and written examinations/term papers.

Course Outline:

Weeks 1,2,3: Discussion of the basic background pertaining to the structure and bonding in inorganic chemistry including transition metal complexes. Quantum numbers, Lewis structures, VSEPR, CFT and d-orbital splitting diagrams. (Ch.1; 4.1-4.3)

Weeks 4,5: Molecular orbital theory/Group Theory and Applications: Review of point groups and applications of group theory. Development of molecular orbital diagrams for molecules including π-bonding effects. (Ch. 4, Vincent text, handouts))

Week 6: Main Group Chemistry: Survey of the s and p block elements and related chemistry. Special topics will include the chemistry of boron and phosphorous. Emphasis on multinuclear NMR studies involving ^{31}P, ^{19}F, ^{13}C, ^{11}B, ^{1}H nuclei. (Selected from Ch10-17; Sec 2.11; handouts)

Week 7: Main Group Chemistry: Survey of the s and p block elements and related chemistry. Special topics will include inorganic cluster chemistry and electron counting rules for boranes, transition metal clusters and heteroatomic substitution in cluster compounds. (Selected from Ch10-17; Sec 2.11; handouts)

Week 8: (TBA) Midterm Examination

Week 9: Transition Metal Chemistry: Review of basic concepts and Jahn Teller distortions, CFSE, molecular orbital diagrams (review), magnetic moments, coordination chemistry, types of ligands, nomenclature, 18 electron rule. (Ch. 19, 20, 23 and handouts)

Week 10: Transition Metal Chemistry: Review of basic concepts and methods of characterization, substitution reactions, redox reactions and fluxional processes. (Ch. 19, 20, 23 and handouts)

Weeks 11,12: Introduction to Organometallic Chemistry and catalytic cycles. (Sec. 23.7; Ch. 26)

Week 13: Presentation of seminars

Week 14: Presentation of seminars

Modes of Instruction:

The course objectives described above will be achieved by:

- Listening to lectures and presentations using audio visual aids.
- Participating in classroom discussions related to published research studies.
- Conducting research, writing papers and assignments.
- Reading assignments (text, handouts, journal articles).
- Partcipating and evaluating presentations.

Required Texts:

1. Housecroft, C. E. and Sharpe, A. G. *Inorganic Chemistry, 3rd Edition*; Prentice Hall: New York, 2008. (ISBN: 978-0-13-175553-6) or Housecroft, C. E. and Sharpe, A. G. *Inorganic Chemistry, 2nd Edition*; Prentice Hall: New York, 2005. (ISBN: 0-13-039913-2)

Recommended Texts:

1. Vincent, A. *Molecular Symmetry and Group Theory, Second Edition;* John Wiley and Sons: New York, 2001. (ISBN 0-471-48939-5) Try www.wiley.com

Instructor References:
Textbooks:

1. Douglas, B., McDaniel, D., Alexander, J. *Concepts and Models of Inorganic Chemistry, Third Edition*; John Wiley and Sons: New York, 1994. (ISBN 0-471-62978-2)
2. Miessler, G. L., Tarr, D. A. *Inorganic Chemistry, Second Edition*; Prentice-Hall: New York, 1999. (ISBN 0-13-841891-8)
3. Shriver, D. F., Atkins, P. W. *Inorganic Chemistry, Third Edition*; W. H. Freeman and Company: New York, 1999. (ISBN 0-7167-3624-1)
4. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M. *Advanced Inorganic Chemistry, Sixth Edition*; Wiley-Interscience: New York, 1999. (ISBN 0-471-19957-5 and earlier versions)
5. Collman, J. P., Hegedus, L. S., Norton, J. R., Finke, R. G. *Principles and Applications of Organotransition Metal Chemistry*; University Science Books: California, 1987. (ISBN 0-935702-51-2)
6. Mackay, K. M., Mackay, R. A. *Introduction to Modern Inorganic Chemistry, Third Edition*; International Textbook Company: London, 1981. (ISBN 0-7002-0278-1)

Journals:

Selected journal articles will also be used where appropriate. An abbreviated list of pertinent journals is listed below.

Title: Organometallics, Inorganic Chemistry, Chemical Reviews, Chemistry of Materials
Publisher: The American Chemical Society

Title: Journal of Organometallic Chemistry, European Journal of Inorganic Chemistry
Publisher: Elsevier

Title: Journal of the Chemical Society, Dalton Transactions, Chemical Communications
Publisher: The Royal Society of Chemistry

Title: Angewantie Chemie, International Edition in English
Publisher: Wiley Interscience

Student References:

Students are expected to consult the aforementioned journals where appropriate. Additional textbooks pertaining to Inorganic Chemistry may be used as additional sources of information.

Method of Evaluation:

Assignments	20%
Midterm Examination	25%
Final Examination	25%
Term Paper	20%
Seminar Presentation	10%

	100%

Assignments:

Assignments will be distributed by the instructor and will involve consultation of texts and current literature. Assignments will be based on application of the material covered during lectures and where appropriate based on current research themes. A total of four assignments will be distributed during the semester. Late submissions will not be accepted and a grade of zero will be assigned. In cases of emergency or illness the instructor must be informed prior to the due date for the assignment or no consideration will be given.

Midterm Examination:

The midterm evaluation will consist of a closed book examination of the material discussed in lecture for the initial seven-week period. The examination will consist of short answer and essay style questions.

Final Examination:

A final examination will consist of 40 multiple-choice questions. The questions will be commensurate with material deemed by the instructor to be suitable for the comprehensive examination. The examination will not be returned to the student!

Term Paper/Seminar Presentation:

Term papers should be approximately 10 type written pages in length. Diagrams should be prepared in a suitable format (ChemDraw™) and not photocopied. Reproductions are acceptable if they involve pictures or diagrams not suitable for reproduction by common computer programs but must be properly referenced (see below). Complete references should be presented in an appropriate ACS format and copies of literature references must be submitted with the paper. A first draft of the paper will be submitted on or before (TBA) for comments and suggestions. The final paper is due on (TBA).

The term papers topics are to be selected from the current literature and approved by the instructor. Only one student is allowed per topic. The objective is to have the student gain an appropriate level of understanding for the selected topic to be able to describe the general principles governing this area (approx. 5 pages) and then focus in on representative current examples in the literature (approx. 1-2 pages per journal article). We may introduce some of these topics briefly in class and the student is expected to expand on this. In writing the term paper and preparing for the seminar you should address key aspects. Define the topic-What class(es) of compounds are you referring to? What are the structure and bonding considerations? What is the unique feature for this class of compounds? How are these compounds synthesized? How are these compounds characterized? How do these compounds react? Attention should also

be drawn to theory we have discussed in class and how it pertains to the topic. For example, are there any distinguishing or unique features in the multinuclear NMR spectra or other methods of characterization? How are the compounds named? What applications are these compounds used for? What are the oxidation state and 18-electron count for the transition metal complexes? Textbooks and review articles are excellent sources for background material but do not merely summarize these reference sources. You must search the literature for up to date examples pertaining to your topic.

Seminar presentations will be held in class (unless otherwise stated) and should be 20 minutes in duration (15 min. presentation, 5 min. for questions). Attendance for all seminar presentations is mandatory since students will also be required to assess the other presentations. Each presentation should begin with general background information on structure, bonding, synthesis, etc. as described above and how it pertains to at least one of the recent examples found in the chemistry literature. You should also address why the article you have selected advances that field of study. What warranted the publication and what is unique about the study performed? It is required that you prepare a 2-3-page summary with appropriate references for the class (I will make photocopies in the chemistry office prior to class). **Do not** read off the slides/overheads you have prepared. This is not an acceptable presentation format. Be prepared to lecture to the class, slides should be a summary of the main points but not the entire presentation. A Powerpoint format is strongly recommended and students should notify the instructor two weeks prior to their presentation so that the appropriate resources can be made available.

Sample Referencing Styles

Journals: There are several acceptable formats however the student should choose one style and use it consistently. The usual order for citing a journal article is: author, journal, year, volume, page number with the appropriate formatting (bold, italics) indicated below.

E.g. Irvine, G. J.; Lesley, M. J. G.; Marder, T. B.; Norman, N. C.; Rice, C. R.; Robins, E. G.; Roper, W.; Whittell, G. R. *Chem. Rev.* **1998**, *9*8, 2685 - 2722.

Books: The format for reporting a book that has been cited follows the order: authors (usually reported if the book is a collection of papers from different authors), title, editors, publisher, publisher location, year of publication, page number (usually if a particular author in the book has been cited).

E.g. *Molecular Electronic Devices*; Carter, F. L., Ed.; Marcel Dekker: New York, 1982.

E.g. Lesley, G.; Yuan, Z.; Stringer, G.; Jobe, I. R.; Taylor, N. J.; Koch, L.; Scott, K.; Marder, T. B.; Williams, I. D.; Kurtz, S. K. In *Organic Materials for Nonlinear Optics II*, Hahn, R. A.; Bloor, D.; Eds.; R. Soc. Chem. Spec. Publ.: Cambridge, 1991, Vol. 91, pp. 197 - 203.

Letter Grade Scale:

The actual grade will be based on the grading scale given below with possible adjustment for class average at the end of the semester (at the instructor's discretion).

A+	**(100-96)**	**B+**	**(85-82)**	**C+**	**(73-70)**	**D+**	**(61-58)**	**F**	**<50**
A	**(95-91)**	**B**	**(81-78)**	**C**	**(69-66)**	**D**	**(57-54)**		
A-	**(90-86)**	**B-**	**(77-74)**	**C-**	**(65-62)**	**D-**	**(53-50)**		