

## Chemistry 4305, 4305A – Advanced Inorganic Chemistry and Laboratory General Information & Grading System

**Professor:** Randal Hallford, PhD

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**Office Hours:** posted

**REQUIRED TEXTBOOK:** Inorganic Chemistry, Shriver et.al. 6<sup>th</sup> edition

Publisher: Freeman plus supplemental material in-class

**RECOMMENDED:** n/a

**PREREQUISITS:** CHEM 3705\*; MATH 2534\*; PHYS 1624 and 2644

**HOMEWORK & LECTURE ATTENDANCE:** Students are expected to work all assigned problems and complete reading assignments. Students are expected to attend each lecture session. *Students will be held responsible for handouts, exercises, laboratory, lecture, and text materials for exam questions.* While there is no point penalty for absences, experience has shown a definite correlation between poor attendance and low grades. Once the lecture starts, students are expected to stay *until the professor dismisses the class*. In addition, students are expected to remain quiet except when addressing questions to the professor. Cell phones and pagers must be turned off. See the Student Handbook.

**PROBLEM SETS:** Problem sets will consist of several problems and are due before the lecture begins on designated due date.

**NO MAKE-UP EXAMINATIONS** will be provided. In the case of an **excused absence**, the *one* missed one-hour examination will be replaced with the appropriate fraction of the final examination score. This means that the final examination score could count twice: first for the final examination and second for a single missed one-hour examination. ACS final results will be posted, but the ACS solutions will not be posted.

**ACADEMIC HONESTY:** The expectation is that all students will act as mature individuals and will exhibit academic integrity at all times. In case of academic dishonesty, faculty regulations require notification of deans, advisers, *etc.* The student should be aware that both “taking” and “giving” improper assistance during examinations constitutes academic dishonesty. Students who are caught cheating on an examination or a quiz may receive an "F" for the *entire* course.<sup>1</sup>

**General Education Statement:** Students in this course must demonstrate their competency in written communication, fundamental mathematical skills, and use of computers through exams, experimentation, and written reports.

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<sup>1</sup> Refer to the MSU student Handbook for University policies about academic honesty and class attendance

\* May be concurrently enrolled

**COURSE CONTENT:** Atomic and molecular systems, symmetry, acid-base chemistry, condensed matter, coordination chemistry, and organometallic chemistry.

**SPECIAL ACCOMMODATIONS FOR STUDENTS:** Federal law protects individuals with disabilities and states that the University must provide appropriate academic accommodations. According to the Americans with Disabilities Acts, it is the responsibility of each student with a disability to notify the University. If any member of this class feels they have a disability that requires special accommodations, please advise the University of this disability and the desired accommodations as soon as possible. The professor will work with disabled students and the Office of Disability Accommodation, 108 Clark Student Center (397-4618), to provide reasonable accommodations to ensure that the students have a fair opportunity to perform favorably in this course.

**IMPORTANT DATES:**

January 20	Martin Luther King Holiday (no classes)
January 21	1 <sup>st</sup> Day of Classes
February 17	May graduation application deadline
March 14 (5:00 pm) – 22	Spring Break
March 30	Last day to drop a course with an automatic “W”
April 8-12	Easter Break Pre-finals Week
May 9, Monday	Final Examination – 9:00 am(ACS Final Exam)

**GRADING SYSTEM:** The following is the point allocation. No additional points will be offered. No points will be dropped. Sufficient time for each assignment has been provided so that absences from illness or accident will not prevent completion (within reason).

Graded Work	Points/Each	Total
Three Mid-Term Examinations	100	300
Final Examination	200	200
ACS comprehensive Final (required)		
5 Problem Sets	100	500
Laboratory Reports (6)	50	300
<b>TOTAL</b>		<b>1300</b>

GRADING SCALE: The following grading scale will be utilized to determine a student's final grade in this course. An "F" can also be earned through academic dishonesty.

Grade	Percent
<b>A</b>	88.0 – 100.
<b>B</b>	76.0 – 87.9
<b>C</b>	64.0 – 75.9
<b>D</b>	52.0 – 63.9
<b>F</b>	00.0 – 51.9

### TENTATIVE LECTURE SCHEDULE

Chapter(s) To Read	Lecture/ Assignment	Topic/Exams
1,2	Unit 1	Nucleosynthesis
		Quantum Chemistry
3	Unit 1 <i>Problem set 1</i>	Quantum Chemistry
		Bonding <b>Exam 1</b>
4,5	Unit 2 <i>Problem set 2</i>	Group Theory
		MO theory
6,7	Unit 3 <i>Problem set 3</i>	Acid-Base
		Solid State <b>Exam 2</b>
9,10	<b>Spring Break</b>	<b>No Work ☹</b>
	Unit 4	Coord. Chem.I
		Coord chem.II
11,12	Unit 4	Coord chem.III
	<b>Easter Break</b>	<b>No Work ☹</b>
	<i>Problem set 4</i>	Coord chem. IV
13	Unit 5	Organometallic, s,p,d,f
14	Unit 5	<b>Exam 3</b>
	<i>Problem set 5</i>	FINAL EXAMS

### Laboratory Syllabus

Pre-Laboratory lecture will occur before each experiment. Laboratory materials will be distributed previous to the appropriate lecture. Additional laboratory periods may be utilized to learn instrumental technique and/or computational methodology as needed.

#### Advanced Inorganic Chemistry laboratory CHEM 4305

Lecture/Grading: R. Hallford, Ph.D. Associate Professor  
Instrumental Laboratory and Advanced Laboratory, RM 321 Bolin Science Hall  
Lecture/pre-lab; RM 328 Dillard 1:30-2:30

Pre-Laboratory lecture will occur before each experiment. Laboratory materials will be distributed previous to the appropriate lecture. Additional laboratory periods may be utilized to learn instrumental technique and/or computational methodology as needed

It is of paramount importance that the student prepares very well for the laboratory period. Most experimental work will require one or two periods of several hours each. Carefully planned procedures are required to successfully complete experiments. It is expected that this will be accomplished outside of laboratory. Failure to adequately prepare and/or complete experiments and analysis will result in damage to the experiment score.

Laboratory notebooks will be kept in the typical research laboratory style. Write-up of experimental results (including any data from instrumental studies and computational work) will be submitted for instructor evaluation and grading. These write ups will be brief, possibly 2-4 pages in length aside from graphs or other accumulated data. Computational experiments will require the addition of an electronic copy of the output files.\* These can be e-mailed.

Under no circumstance will a cooperative effort be accepted for analysis and formal write up of data. Students may need to share data accumulated for an experimental product. If ANY indication of cooperation in the analysis and formal discussion of an experiment is noted, a zero for ALL PARTIES INVOLVED will be earned. A complete description of notebook and write-up methods will be provided.

Experiments:

- 1.\* **Synthesis of metal acetylacetonate.** *Product will be utilized for other experiments.* **Preparation of Tris(2,4-pentanedionato)chromium(III)**
- 2.\* **Absorption Spectra of Transition Metal Complexes.** A uv-vis and diffuse reflectance analysis of the d-d symmetry allowed transitions of complex metals. ( UV-VIS spectrometer, IR spectrometer)
- 3.\* **Spectroscopic Determination of  $\Delta_o$  in Cr(III) complexes** (UV-VIS spectrometer)
- 4.\* **Reaction of Cr(III)with the multidentate ligand EDTA:** a kinetics experiment. UV-VIS spectrometer- timed programming
5. **Molecular Modeling:** a semi-empirical analysis of the kinetic vs thermodynamic properties of an experimental product: *cis-trans* temperature dependence of a copper-glycine complex. This will require one lab period for instruction for utilizing **computational software.**
6. **Synthesis of Bio-Inorganic Complexes: A *cis-trans* isomerization study of**
  - a) *cis*-Bis(glycinato)copper(II) monohydrate and
  - b) *trans*-Bis(glycinato)copper(II)

**computational software**

\*Wet-lab experiments requiring supervision and laboratory facilities