

Morehead State University
College of Science & Technology; Department of Biology & Chemistry
Chemistry 351 - Bioinorganic Chemistry (3 credits)
Fall 2010

Instructor: Dr. Ann M. Macintosh
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Office Hours: MWF1 10:20-11:20 am, TuThF2 9:10-10:10 am and by appointment
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Prerequisite: Chem 326

Corequisite: The lab is a mandatory part of this course.

Lecture: TuTh 11:30-12:30

Text: E. Ochiai Bioinorganic Chemistry: A Survey

Reserve

Readings: S. J. Lippard and J.M. Berg Principles of Bioinorganic Chemistry
J.A. Cowan Inorganic Biochemistry 2nd Ed
G. E. Rodgers Introduction to Coordination, Solid State, and Descriptive Inorganic Chemistry.
Copies of General Chemistry textbooks are available in LA 426

Program competencies addressed: (method of assessment)

- 3) Read technical literature with good comprehension. (exams and case study)
- 4) Write technical reports in a clear and logical way. (lab reports)
- 5) Present oral reports on technical material in a clear and logical way.
(case study)
- 8) Be able to use the basic principles of chemistry as presented in the first-year class in a wide-variety of contexts, especially the relationship of the microscopic physical picture to the bulk chemical behavior. Be able to relate scientific principles to observed behavior. (exams and lab reports)
- 9) Comprehend major systems of nomenclature used in chemistry and know enough about basic functional groups of inorganic and organic chemistry to have a primitive vocabulary of basic types of chemical reactions and to be able to use this to make rational chemical predictions. (quizzes and exams)

Description: Structure of inorganic compounds. Electron transfer reactions, acid-base theories, kinetics and reaction mechanisms, and relationship of thermodynamics to structure and reactivity of inorganic compounds. Concepts will be taught using biological systems or model compounds for these systems as examples.

Attendance: Lecture Attendance is essential to your success and is expected. Lab attendance is required, **if you miss more than 2 labs and/or fail to turn in lab reports for 3 weeks of lab work you will receive a failing grade and must repeat the course.**

University Excused Absences (See Student Handbook or UAR 131.01):

- 1) Required attendance at a university function, with supporting documentation from the event sponsor. You must notify me in advance. These activities must be approved by the appropriate university office.
- 2) Illness or Injury. You must submit written confirmation of treatment by medical practitioner. This documentation must be submitted to the Assistant Vice-President for Student Life/Dean of Students.
- 3) Critical/Illness Death in the Immediate Family (as defined in the Student Handbook). Students must provide documentation of circumstances to the Assistant Vice-President for Student Life/Dean of Students.
- 4) Short-Term Military Obligations, to be excused through Associate Vice President for Academic Programs.
- 5) Jury duty or Subpoena for court appearance.
- 6) Major religious holiday, to be excused by Assistant Vice-President for Student Life/Dean of Students.

If you must miss an exam for any other reason, which you believe is valid, see me about it, before the absence, if at all possible.

Campus Safety Statement:

Emergency response information will be discussed in class. Students should familiarize themselves with the nearest exit routes in the event evacuation becomes necessary. You should notify your instructor at the beginning of the semester if you have special needs or will require assistance during an emergency evacuation. Students should familiarize themselves with emergency response protocols at <http://www.moreheadstate.edu/emergency>

Disabilities Statement:

In compliance with the ADA, all students with a documented disability are entitled to reasonable accommodations and services to support their academic success and safety. Though a request for services may be made at any time, services are best applied when they are requested at or before the start of the semester. To receive accommodations and services the student should immediately contact the Disability Services Coordinator in the Office of Academic and Career Services, 223 Allie Young Hall, 606-783-5188, www.moreheadstate.edu/acs/. It is the student's responsibility to inform your instructor of your needs for accommodations.

General Policies:

- 1) If you have to miss an exam, please notify me in advance, if possible.
- 2) If you miss an exam with an excused absence, I will count your final exam grade in place of that exam grade.
- 3) Late assignments will not be accepted except in the case of an extended illness.
- 4) In order to receive a passing grade for the course, you must pass **both** the lecture and the lab portions of the class.

Academic Honesty:

Cheating, fabrication, plagiarism or helping others to commit these acts will not be tolerated. Academic dishonesty will result in severe disciplinary action including, but not limited to, failure of the student assessment item or course, and/or dismissal from MSU. If you are not sure what constitutes academic dishonesty, read The Eagle: Student Handbook or ask your instructor. The policy is located at <http://www.morehead-st.edu./units/studentlife/handbook/academicdishonesty.html>. For example: Copying information from the Internet is plagiarism if appropriate credit is not given.

Quizzes:

Quizzes covering general chemistry review topics, the current day's reading or the previous class material will be given at the start of selected class periods. If you miss a quiz without an excused absence, you will receive a zero for that quiz. There will be no make-up quizzes. If you miss a quiz with an excused absence (and provide proper documentation) I will ignore that quiz when calculating your final grade.

Case Studies:

Each student will make a 10-15 minute oral presentation on topic selected from a list of possible case studies. Students may select a topic not on list if the student obtains prior approval from the instructor. The list of possible case studies and a grading rubric for the presentation will be distributed prior to midterm.

Laboratory safety:

Laboratory safety is of utmost importance in this course, so safe attire is mandatory. In particular, **APPROVED EYE PROTECTION AND A LAB APRON MUST BE WORN WHENEVER EXPERIMENTS ARE IN PROGRESS**; there are no exceptions to this rule!

Grading:

The final grades in this course will be calculated using the following scale:

Quizzes	5 %
Oral Presentation of Case Study	7 %
Class Participation	5 %
Exams	38 %
Final Exam	20 %
Laboratory	25 %

Final letter grades will be assigned using the following scale:

85 - 100 %	A
75 - 84.9 %	B
65 - 74.9 %	C
55 - 64.9 %	D
below 55	E

Tentative Reading Schedule Chemistry 351 Fall '09 Dr. Macintosh

Day	Topic	Reading
1	Course Introduction; Distribution of Elements; "Essentiality"; Dose-Response Curves	Ochiai: 1.1: <i>J. Chem. Ed.</i> 1985 , 62, 917.
2	Biological Needs for Elements: Behavior of Inorganic Elements; Fundamentals of Coordination Chemistry	Ochiai: 2.1-2.4.1
3	Nomenclature of Coordination Compounds; Basics of Protein Structure	Handout; Ochiai: pp. 10-16
4	Introduction to Crystal field Theory	Rodgers pp.57-66
5	Consequences and Application of Crystal Field Theory	Rodgers pp. 67-74
6	Magnetism; Coupling of Magnetic Moments; Magnetic Sensors; Magnetic Navigation	Rodgers 75-77; Cowan 2.3.3; 6.7.2; Ochiai: 10.2.6
7	Absorption Spectroscopy and Colors of Coordination Compounds; Charge Transfer Spectra	Rodgers 77-81; Cowan 2.2.1
8	Kinetics and Substitution	Ochiai: 2.4.5
9	Definitions of Acids and Bases: Bronstead, Lewis and Hard/Soft	Ochiai: 4.1-4.1.3; Wulfsberg: pp. 267-273
10	Biological Applications of HSAB	Wulfsberg: pp. 292-300
11	Kinetic Factors of Acid-Base Reactions; Enhancement of Reactions by Protein Residues: Mg Dependent Enzymes; Zn Dependent Enzymes	Ochiai: 4.1.4-4.3.5
12	Exam 1	
13	Other Metal Cation-Dependent Acid-Base Enzymes: Structural Effects of Metal Ions	Ochiai: 4.4-4.5; 10.2.2.2 Lippard: 178-184
14	Mechanisms of Electron Transfer Reactions	Cowan: 1.8
15	Nitrite Reductase; Blue Copper Proteins; Superoxide Dismutase (SOD)	Ochiai: 5.2.2; 5.3.1- 5.3.2; 5.3.6
16	Xanthin oxidase & Aldehyde Oxidase; Sulfite Oxidase and Nitrate Reductase (assimilatory); Water Oxidase	Ochiai: 5.4.1-5.4.2; 5.5.2
17	Molecular Orbital Diagram of O ₂	Handout
18	X-ray Crystallography	Handout
19	Introduction to Oxygen Carrier Proteins; Hemoglobin and Myoglobin	Ochiai: 6.2; Lippard 291-297
20	Raman Spectroscopy	Cowan: 2.2.3
21	Hemyrithrin and its Model Complexes	Lippard: 291-297
22	Hemocyanin and its Model Complexes	Lippard: 297-302
23	Exam 2	
24	Iron Monooxygenases	Ochiai: 6.3-6.3.3
25	Ionophores ; Siderophores	Cowan 3.2.1; Ochiai: 10.1.1.8
26	Synthetic Ionophores and Ion Channels	Ochiai: 10.2.1.2
27	Nitrogenase	Ochiai: 8.1-8.4

28	Case Studies Day 1	
29	Case Studies Day 2	
30	Case Studies Day 3	
	Comprehensive Final Exam: Monday Dec. 13 12:45-2:45 PM	

Chem 351-L Schedule Fall 2010

Week	Date	Experiment
1	Aug. 24	The Ligand Field Spectra of Copper(II) Complexes
2	Aug. 31	The Ligand Field Spectra of Copper(II) Complexes Con't
3	Sept. 7	Bioinorganic Coordination Chemistry: metalloporphyrins
4	Sept 14	Bioinorganic Coordination Chemistry: metalloporphyrins Con't
5	Sept. 21	Bioinorganic Coordination Chemistry: metalloporphyrins Con't
6	Sept. 28	Determination of Myoglobin Stability by Visible Spectroscopy
7	Oct. 5	Enzyme Kinetics with Horseradish Peroxidase: Introduction to data analysis
8	Oct. 12	Enzyme Kinetics with Horseradish Peroxidase
9	Oct. 19	Enzyme Kinetics with Horseradish Peroxidase Con't
10	Oct. 26	Excited State Electron Transfer in Transition Metal Complexes
11	Nov. 2	Excited State Electron Transfer in Transition Metal Complexes
12	Nov. 9	Synthesis Cobaloximes
13	Nov. 16	Synthesis Cobaloximes II
14	Nov. 23	Characterization of Cobaloximes
15	Nov. 30	Determination of the Composition of a Complex Ion; Job's Method
16	Dec. 7	Check-out