SYLLABUS
Chemistry 208
Summer, 2022

GENERAL CHEMISTRY II & INTRODUCTION TO INORGANIC CHEMISTRY

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ISC 1039A
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Office Hours: daily 1:30 – 2:30 PM
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Course Goals: (a) complete the coverage of general chemistry begun in Chemistry 103 including principles of kinetics, equilibrium, bonding, structure, thermodynamics, electrochemistry, coordination chemistry, and radiochemistry and (b) introduce inorganic concepts including bonding, nomenclature, and electronic structure in the transition metals. The course is primarily intended for science majors and pre-health science students.

Mandatory Materials:

1) OpenStax Chemistry: Atoms First, 2e. Available as free pdf or $65 hard copy at https://openstax.org/details/books/chemistry-atoms-first-2e
2) Introduction to Inorganic Chemistry. Available for free at https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
3) *MacMillan Achieve* Homework (HW): ($42). www.achieve.macmillanlearning.com/start Sign up for *Chem 208 Summer 2022 Pike*
4) *Piazza* will be used for class discussion and help. There is no charge to use Piazza. Sign up at https://piazza.com/wm/summer2022/chem208

Lectures: Daily, 8:30–10:00 AM, ISC 1280

Examinations: Each of the three exams covers about a third of the course material and contains (i) problems requiring numerical answers similar to the problems in the problem sets, (ii) short-answer questions, and (iii) multiple-choice questions. Your weakest exam will be counted only half as much as your other two exams.

Grading:

		Syllabus Topics	**Chapters**	**Date**
34%*	First Test	I − II	17, 14	July 15 (Friday)
34%*	Second Test	III − V	9, 14, 15, 16	July 29 (Friday)
34%*	Third Exam	VI – VIII	4, 5, 19, 20	Aug. 5 (Friday)
15%	Problem Sets	(coverage and due dates given below)		

*The weakest of your three exams will count only half as much (17%) as the other two (34% each).

Note: Make-up tests are not typically permitted. If you must miss an exam, please submit the

reason to me in writing one week in advance. If it is valid, you may take the exam early.

Problem Sets: Working problems is important for reinforcing the chemical principles emphasized in the lecture and text.
Graded Homework Sets: There are ten graded homework set assignments. The coverage and availability dates of the homework sets are listed below. These homework sets are available through *MacMillan Achieve*. Each set must be completed by 11:59 PM on the day indicated and will be automatically graded through *Achieve*. To help with the learning process, you are being given unlimited tries without penalty to get correct answers for each problem. Note that the homework set deadlines are firm. No homework set will be accepted late and granting of an extension will require very compelling circumstances. You may work in groups; however each student is ultimately responsible for mastering the material for him/herself. Solutions to the assigned problems will be posted on *Achieve* after the homework set is due.

***Achieve* Homework Sets (graded)**

Problem Set #	Lecture Units	Date Available	Date Due
1	I	July 1st 8:00 AM	July 9th 11:59 PM
2	IIA-C	July 6th 8:00 AM	July 9th 11:59 PM
3	IIC, IIIA-B	July 10th 8:00 AM	July 13th 11:59 PM
4	IIIC-D	July 13th 8:00 AM	July 16th 11:59 PM
5	IIIE, IVA	July 17th 8:00 AM	July 20th 11:59 PM
6	IVB-C, VA-B	July 20th 8:00 AM	July 23rd 11:59 PM
7	VD-F	July 24th 8:00 AM	July 27th 11:59 PM
8	VI	July 27th 8:00 AM	July 30th 11:59 PM
9	VII	July 31st 8:00 AM	Aug. 3rd 11:59 PM
10	VIII	Aug. 3rd 8:00 AM	Aug. 5th 11:59 PM

How to access *Achieve*: Go to www.achieve.macmillanlearning.com/start to log in or create an account.

Ungraded Practice Problems: There are numerous problems and exercises within and at the end of each text chapter. Many of these problems are very similar to the assigned problems in the homework sets. You should practice these problems if you are having difficulty with an assigned problem. A suggested list of end-of-the-chapter practice problems is given below.

Textbook Practice Problems (not graded)

Unit	Problems
I	Chapter 17: Reaction Rates & Factors Affecting Reaction Rates odds 1-11; Rate Laws odds 13-33; evens 34-50; Collision Theory evens 52-66; Reaction Mechanisms & Catalysis evens 68-78, 79 & evens 82-86.
II	Chapter 14: Bronsted Acids & Bases odds 1-13; pH/pOH odds 15-25; Acid/Base Strength: odds 27-47; evens 48-68; Salts 70; Polyprotics evens 72-76.
III	Chapter 14: Buffers evens 78-90; Titrations 92, 94. Chapter 15: Precipitation odds 1-59; Lewis Acids/Bases evens 62-84; Coupled Equilibria evens 86-90, odds 93-105, 106.
IV	Chapter 9: (Review) Enthalpy odds 39-49, 55-71, 79, 83; Hess's Law odds 73, 75, 81, 85.

Chapter 12: Spontaneity odd 1-5; Entropy (Qualitative) odd 7-19; Entropy (Quantitative) odd 21-29; Free Energy odd 31-41, even 42-50.

V Chapter 16: Review Redox odd 1-9; Galvanic Cells odd 11-10; Cell Potentials odd 21-25; ΔE, ΔG & Q/K_{eq} odd 27-31; Batteries & Fuel Cells 33, 34, 36; Corrosion even 38-42; Electrolysis even 44-48.

VI Chapter 4 (Review) Lewis Structures evens 38-42, 48, 54; Formal Charges & Resonance evens 55-74. Chapter 5: Valence Bond Theory odds 1-5; Hybrid Atomic Orbitals odds 7-19; Multiple Bonds odds 21-29; Molecular Orbital Theory odds 31-47.

VII Chapter 19: General Properties 1, 3, 7, 11, 13, 15, 21, 23, 25; Coordination Chemistry odds 27-35; Crystal Field Theory odds 37-47.

VII Chapter 20: Nuclear Structure & Stability odds 1-9; Nuclear Equations & Radioactive Decay odds 11-45; Transmutation & Nuclear Energy odds 47-53; Uses & Biological Effects of Radiation odds 55-59.

Course Schedule

Date		Topic
	I.	Chemical Kinetics (Chapter 17)
July 5		A. Reaction rates (17.1,2)
		B. Rate laws and reaction order (17.3)
July 6		C. First-order reactions (17.4)
		D. Kinetics and mechanism (17.5,6)
July 7		E. Catalysts and temperature effects (17.7)
	II.	Acids and Bases (Chapter 14)
July 8		A. Review of elementary concepts (14.1,2)
		B. Weak acids and bases (14.3)
July 11		C. Acid/base properties of salts (14.4)
		D. Polyprotic acids and bases (14.5)
---------- EXAM I Coverage ----------		
	III.	Aqueous Equilibria (Chapters 14, 15)
July 12		A. Solubility products (15.1)
		B. Structural effects and Lewis acid/base model (15.2)
July 13		C. Common ion effect and buffers (14.6)
July 14		D. Titrations (14.7)
July 18		E. Complex ion equilibria (15.3)
	IV.	Spontaneity, Entropy, and Free Energy (Chapters 9, 12)
July 19		A. Review of thermochemistry (9)
		B. Entropy and the second law (12.1−3)
July 20		C. Free energy, spontaneity and equilibrium (12.4)
	V.	Electrochemistry (Chapter 16)
July 21		A. Review of redox reactions (16.1)
		B. Voltaic (galvanic) cells (16.2)
		C. Standard reduction potentials (16.3)
July 22		D. Non-standard conditions: the Nernst equation (16.3)

E. Electrolytic cells (16.7)
July 25 F. Energy calculations

---------- **EXAM II Coverage** ----------

VI. Covalent Bonding (Chapters 4, 5)
A. Review of the octet rule and Lewis dot structures (4.2−6)
July 26 B. Expansion of octets (4.4)
C. Hybrid orbitals (5.2)
July 27 D. Molecular orbital theory (5.4)

VII. Transition Metal and Coordination Chemistry (Chapter 19)
July 28 A. Oxidation states and ligands (19.1)
B. Coordination complexes: nomenclature and isomerism (19.2)
Aug. 1 C. Crystal field theory (19.3)

VIII. Nuclear Chemistry (Chapter 20)
Aug. 2 A. Nuclear stability and radioactive decay (20.1−3)
B. Decay rates and radio-dating (20.5)
Aug. 3 C. Binding energy (20.1)
D. Fission and fusion (20.4)

---------- **EXAM III Coverage** ----------

Policies and Resources:

Student Accessibility Services: William & Mary accommodates students with disabilities in accordance with federal laws and university policy. Any student who feels they may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at sas@wm.edu to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please see www.wm.edu/sas.

Honor Code: All students are expected to follow the W&M Honor Code. Any suspected violation of academic integrity will be taken very seriously and pursued to the furthest extent possible.
All students are expected to abide by the University's Healthy Together Community Statement.

Mental and Physical Well Being: William & Mary recognizes that students have many different responsibilities and can face challenges that make learning difficult. There are many resources available at W&M to help students. Asking for help is a sign of courage and strength. Please reach out to me if you or someone you know are facing problems inside or outside the classroom, and I will do my best to guide you to appropriate resources on campus. Those resources include:

- For psychological/emotional stress, there is the W&M Counseling Center (757-221-362), 240 Gooch Dr. 2nd floor, https://www.wm.edu/offices/wellness/counselingcenter/). Services are free and confidential.

- For physical/medical concerns, there is the W&M Health Center (757-221-4386), 240

Gooch Drive, https://www.wm.edu/offices/wellness/healthcenter/

- For other additional support or resources, please contact the Dean of Students by submitting a care report (757-221-2510) or by email at deanofstudents@wm.edu https://www.wm.edu/offices/deanofstudents/services/caresupportservices/index.php