

**Chemistry 205 – Advanced General Chemistry
Fall 2022**

When: MWF 9:00 – 9:50 AM

Where: Small 111

Instructor: Lisa M. Landino, Ph.D.

Office/phone/e-mail: Integrated Science Center 1283, 221-2554, lmland@wm.edu

Office Hours: Tuesday 1:30 to 2:30 PM; Thursday 12:30 to 1:30 PM and by appointment.

Course Description: A systematic study of the properties and reactions of chemical elements and their compounds, including equilibrium, acid/base chemistry, thermodynamics, electrochemistry, bonding, kinetics and an introduction to coordination chemistry. **Further, this course will explore how the quest for natural resources and synthetic chemicals has shaped our modern society.** Students must have William & Mary credit for CHEM 103 by 1) successful completion of Chem 103; 2) Advanced Placement score of 4 or 5; 3) International Baccalaureate credit or 4) a score of 70% or better on the placement test.

Required Books: Chemical Principles by Zumdahl & DeCoste (8th edition) Brooks/Cole (Cengage Learning). ISBN 978-1-305-58198-2; Napoleon's Buttons: 17 molecules that changed history by Penny le Couteur and Jay Burreson. Penguin Publishing, ISBN 978-1-58542-331-6.

Biomolecular Archaeology: An Introduction by Terry Brown and Keri Brown. Wiley-Blackwell, 2011. ISBN 978-1-4051-7960-7. E-book is available FREE via Swem Library catalog. (only 1 chapter required)

Exams and Grades: Your final grade will be based on a possible 1000 points distributed as follows:

Pre-test (to assess your preparation)	30 points
Homework (8 assignments: 15 points each)	120 points
Infographics (2 x 4 points)	80 points
Lecture Exam 1	180 points
Lecture Exam 2	180 points
Lecture Exam 3	180 points
Final Exam	230 points

Exams will be in class on: Monday, September 26th, Wednesday October 19th, Friday November 18th

Letter grades will be determined according to this scale:

Grade	Final average	
A	93 – 100	Final course averages will be determined for each member of the class and then those averages will be used to generate a class mean. If the class mean falls at or above 83%, then grades will be assigned based on the scale shown. If the class average is below 83%, then all individual averages will be adjusted UP in an equivalent manner. No grades will be adjusted down!
A-	89 – 92.9	
B+	85-88.9	
B	81-84.9	
B-	77-80.9	
C+	73-76.9	
C	69-72.9	
C-	65-68.9	
D/D-	55 - 64.9	
F	< 55	

Absence Policy You are expected to be present for all in class exams. If you know that you will have a conflict due to a College function such as varsity sports, choir, etc., you must notify me well **in advance** of your absence. In case of serious illness or death in the family, please notify the appropriate campus office (Health Center or Dean of Students, respectively). For these excused absences, you will need to re-schedule the exam as soon as possible.

If you miss an exam for any other reason, there are no makeup exams and your other exam scores will count more. Excused absences **do not include** early departures or late returns from weekends/fall break, fraternity/sorority functions, family reunions, etc.

Please be attentive in class! No talking, texting, web surfing or other disrespectful/disruptive behavior!

Problem/help sessions These will be announced in class and by e-mail (certainly before exams). Attendance is optional but encouraged. I will try to record them as well.

Homework assignments (8): Homework questions to be graded will be posted on Blackboard at least one week prior to their due date. Any changes to the graded homework assignments or their due dates will be announced in class and posted on Blackboard. *A portion or all of each assignment will be submitted via Blackboard.* For the COLL 200 part of the course, answers to reading questions from Napoleon's Buttons or Biomolecular Archaeology will be submitted by Blackboard.

Late assignments will incur a 20% deduction per 24 hour period. If the answer key has already been posted, then late assignments will not be graded (grade = ZERO). You may work on homework problems with other students although it is in your best interest to solve the problems independently. Additional suggested problems from the textbook will be posted on Blackboard. These additional problems will not be graded but may show up on an exam. Complete solutions for all problems, graded and suggested, will be posted on Blackboard.

Infographics (2): As part of the COLL 200 CSI component, students will propose their own molecule or class of molecules that changed history. Students may choose a naturally occurring or synthetic molecule. The **one page infographic** will include the chemistry and the historical and societal context in enough detail to justify why you made your choice. Additional information about the format of the assignment will be posted on Blackboard as the due dates approach. One of the infographics must be "historical" – more than 50 years old and the other must be more modern. You may choose a molecule that is in Napoleon's Buttons (but only from chapters not covered in class).

Chapters from Napoleon's Buttons to be directly incorporated into the course content (in presentation order)

15. Salt; 2. Ascorbic Acid (Vitamin C); 13. Morphine, nicotine and caffeine; 5. Nitro compounds: gunpowder, dynamite and modern explosives; 16. Chlorocarbon compounds (and their role in the environment); 17. Molecules against Malaria

Chapters from Biomolecular Archaeology to be directly incorporated into the course content (in presentation order)

6. Stable Isotopes 12. Studying the diets of past people

Culture, Society and the Individual (CSI) assessment component:

Approximately 25% of each homework assignment will be directly related to the readings in Napoleon's Buttons or Biomolecular Archaeology (25% of 120 points = 30 pts)

The infographic assignments will be modeled after chapters of Napoleon's Buttons and therefore students will address not only the chemistry of their chosen molecule but the historical and societal context. (100% of 80 points = 80 pts)

Approximately 5% of Exam 3 will directly test some understanding of the use of stable isotopes in archaeology. 5% of 180 points = 9 pts

Exams 1, 2 (3% of each) and the final exam (5%) will also evaluate understanding of the CSI component of the course.

Points of CSI component = 30 + 80 + 9 + 5.4 + 5.4 + 12 = 141.8 of 1000 total (14.2%)

Class time devoted to CSI topics: Lectures highlighted in **red** will focus on the historical and societal context of the molecules or chemistry concepts presented. Portions of other lectures will contain historical content relevant to the timeline of scientific discovery.

Date	Lecture #	Lecture schedule for chemistry 205
8/31 W	L1	Course intro; explanation of CSI portion of the course ; review symbols & arrows
9/2 F	L2	review Equilibrium (Chapter 6)
9/5 M		No class; Labor Day
9/7 W	L3	Acid/Base - Chapter 7.1 - 7.4 Salt
9/9 F	L4	7.5 - 7.6 Calculating the pH of weak acid solutions; bases
9/12 M	L5	7.7 - 7.8 Polyprotic acids; Acid/base properties of salts Ascorbic Acid
9/14 W	L6	Applications of aqueous equilibrium - Common ions and buffers 8.1 - 8.2
9/16 F	L7	buffer calculations, blood buffer example and start titrations
9/19 M	L8	8.5 - 8.6 Titration and pH curves: monoprotic and polyprotic acids
9/21 W	L9	start 8.8 solubility equilibria and K_{sp}
9/23 F	L10	8.9 K_{sp} : common ion effect and precipitation; effect of pH/buffers
9/26 M		Exam 1
9/28 W	L11	Flint water and amine-based drugs Morphine, nicotine and caffeine
9/30 F	L12	Review chapter 9: (thermochemistry and enthalpy); start entropy (Ch 10)
10/3 M	L13	10.1, 10.3-10.5 10.6 - 10.8 Entropy and organized systems Nitro compounds (explosives) ; start Free energy (10.9)
10/5 W	L14	10.9 - 10.12 Free energy and equilibrium
10/7 F	L15	11.1 - 11.2 Galvanic cells and standard reduction potentials
10/10 M	L16	11.3-11.4 Cell potential and free energy; the Nernst equation
10/12 W	L17	11.7-11.8 Electrolytic cells and practice problems
10/14 F		Fall Break
10/17 M	L18	11.5-11.6 Batteries, corrosion and environmental issues
10/19 W		Exam 2
10/21 F	L19	Review Chapter 13 Bonding: general concepts; Chapter 14 overview
10/24 M	L20	14.1 - 14.2 Covalent bonding: molecular orbitals (MOs) & MO diagrams
10/26 W	L21	14.3 MO diagrams of homonuclear diatomic molecules including O_2
10/28 F	L22	14.4 - 14.5 Reactive oxygen species (ROS) & heteronuclear diatomic molecules
10/31 M	L23	Chemistry of nitrogen 18.8 pp. 750-758 Nitro compounds (explosives)
11/2 W	L24	Chemistry of nitrogen & oxygen compounds; intro to ozone 18.11 pp. 761-762
11/4 F	L25	Chlorocarbon compounds (ozone and environmental issues)
11/7 M	L26	Refrigerants ; start nuclear particles
11/9 W	L27	20.1 - 20.2 Nuclear stability and the kinetics of radioactive decay
11/11 F	L28	20.3 - 20.4 Nuclear transformations; detection and uses of radioactivity
11/14 M	L29	20.5 - 20.6 Thermodynamic stability of the nucleus; nuclear fission and fusion
11/16 W	L30	Stable isotopes in archaeology – ratios in bones & teeth
11/18 F		Exam 3
11/21 M	L31	Applications of stable isotopes – Stonehenge & strontium isotopes REMOTE
W & F		11/23 & 11/25 Thanksgiving break!
11/28 M	L32	19.1-19.2 Transition metals and coordination chemistry
11/30 W	L33	19.3 - 19.4 Coordination compounds and isomerism
12/2 F	L34	19.5 - 19.6 Bonding in complex ions; the crystal field model
12/5 M	L35	19.7 - 19.8 The molecular orbital model and biological coordination complexes
12/7 W	L36	Why is blood red? - hemoglobin and oxygen binding
12/9 F	L37	More hemoglobin plus Molecules against malaria

Final exam Wednesday, December 14, 2022 9 am to noon

What is cheating?

Cheating will be not tolerated at William & Mary. I know that all new students learn about the W&M Honor Code (during Orientation) and pledge to follow it. In recent years, too many students have submitted questions to Chegg or similar websites; as a result, many have been charged with Honor Code violations. The consequences can be severe and long-lasting.

For homework assignments, you may work with classmates. If you have a tutor, it's fine to ask them to help with homework. But be warned that, during in class, closed book exams, you will not have those resources. Smartphones will not be used to replace calculators during in class exams.

What is the best way to contact Professor Landino?

I routinely email the entire class using the Blackboard "send email" option. Please check your email regularly. If you email me with a quick question, I will try to respond within 2 hours during the day (8 AM to 5 PM). If you email me after 5 PM, don't expect an answer until the following morning. I am an early riser and often answer emails very early in the morning.

Will we have any remote classes?

My goal is to meet in person all semester. However, in case of illness, I may post videos to keep on schedule. In the past I have not recorded lectures, only posted my notes. This semester, I will do my best to record lectures AND post notes in case students miss classes due to illness or other circumstances.

Where are things on Blackboard?

Look at the Folders on the left side. Notes will be in the Lecture Notes folder. Videos will be in the Panopto content folder inside the Tools folder). Assignments and answer keys will be in the Assignments folder. Each midterm exam have its own folder with sample questions and even old exams and answer keys.