Chemistry 205 – Advanced Freshman Chemistry
Fall 2018

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: To be determined

Course Description: A systematic study of the properties and reactions of chemical elements and their compounds, including acid/base chemistry, thermodynamics, electrochemistry, bonding, and an introduction to kinetics. **This course will explore how the quest for natural resources and synthetic chemicals has shaped our modern society.** Enrollment is restricted to freshmen who receive William and Mary credit for Chemistry 103 with a score of 4 or 5 on the Advanced Placement Examination in Chemistry or have instructor consent.

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.

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

Pre-test (show me what you know!)	30 points
Homework (6 assignments: 6 x 2 points)	120 points
Writing assignment	80 points
Lecture Exam 1	180 points
Lecture Exam 2	180 points
Lecture Exam 3	180 points
Final Exam	240 points

Exams will be in class on: Friday, September 21st , Friday October 12th, Monday November 19th

Letter grades will be determined according to this standard scale:

Grade	Final average
A	93 – 100
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

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 82%, then grades will be assigned based on the scale shown. If the class average is below 82%, then all individual averages will be adjusted UP in an equivalent manner. **No grades will be adjusted down**!

Absence Policy You are expected to be present for all class exams and if you know that you will have a conflict with an exam due to a College function such as varsity sports, choir, etc., you must notify me **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) and bring documentation from that office upon your return to class. For these excused absences, you will need to re-schedule the exam as soon as possible. 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 texting, web surfing or other disrespectful/disruptive behavior allowed!

Problem/help sessions These sessions (certainly before exams) will be announced in class and by e-mail. Attendance is optional but encouraged.

Homework assignments: Homework problems to be graded (2 or 3 usually) 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. Portions of each homework assignment will pertain to the assigned reading from Napoleon's Buttons or Biomolecular Archaeology.

Late assignments will incur a 10% 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.

Writing Assignment: 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 man-made molecule. The paper (5-6 pages) will include the chemistry, the historical and societal context, and the student's rationale for their choice. Additional information about the format of the assignment will be posted on Blackboard.

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); 1Molecules 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
15. Studying disease in the past

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 writing assignment 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 their 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 schedule for chemistry 205
8/29 W	Course intro; review Equilibrium (Chapter 6) explanation of CSI portion of the course
8/31 F	Acid/Base - Chapter 7.1 - 7.4 Salt
9/3 M	7.5 - 7.6 Calculating the pH of weak acid solutions; bases
9/5 W	7.7 - 7.8 Polyprotic acids; Acid/base properties of salts Ascorbic Acid
9/7 F	Applications of aqueous equilibrium - Common ions and buffers 8.1 - 8.2
9/10 M	8.3 - 8.4 buffers/biochemical applications
9/12 W	8.5 - 8.6 Titration and pH curves: monoprotic and polyprotic acids
9/14 F	8.7 indicators; start 8.8 solubility equilibria and K_{sp}
9/17 M	8.9 K_{sp} and precipitation
9/19 W	Biochemical and environmental examples for solubility and K_{sp} Morphine, nicotine and caffeine
9/21 F	**Exam 1**
9/24 M	Review Chapter 9 (thermochemistry and enthalpy)
9/26 W	10.1, 10.3-10.5 Thermodynamics - Overview of entropy
9/28 F	10.6 - 10.8 Entropy and organized systems Nitro compounds (explosives)
10/1 M	10.9 - 10.12 Free energy and equilibrium
10/3 W	11.1 - 11.2 Galvanic cells and standard reduction potentials
10/5 F	11.3-11.4 Cell potential and free energy; the Nernst equation
10/8 M	11.5-11.6 Batteries and corrosion Environmental issues
10/10 W	11.7 - 11.8, the Nernst equation and some biochemical redox reactions
10/12 F	**Exam 2**
10/15 M	*Fall Break*
10/17 W	Review Chapter 13 Bonding: general concepts: Chapter 14 overview
10/19 F	14.1 - 14.2 Covalent bonding: orbitals
10/22 M	14.3 molecular oxygen
10/24 W	14.4 - 14.5 heteronuclear diatomic molecules
10/26 F	Chemistry of nitrogen 18.8 pp. 750-758 Nitro compounds (explosives)
10/29 M	Chemistry of oxygen including ozone 18.11 pp. 761-762
10/31 W	15.1-15.5Chemical kinetics
11/2 F	Chlorocarbon compounds (ozone and environmental issues)
11/5 M	15.7 & 15.9 Catalysis and Enzymes
11/7 W	20.1 - 20.2 Nuclear stability and the kinetics of radioactive decay
11/9 F	20.3 - 20.4 Nuclear transformations; detection and uses of radioactivity
11/12 M	20.5 - 20.6 Thermodynamic stability of the nucleus; nuclear fission and fusion
11/14 W	Research applications of nuclear chemistry (20.7) and stable isotopes
11/16 F	Stable isotopes in archaeology – studies of diet, disease and migration
11/19 M	**Exam 3**
	11/21 & 11/23Thanksgiving break!
11/26 M	19.1 - 19.2 Transition metals and coordination chemistry
11/28 W	19.3 - 19.4 Coordination compounds and isomerism
11/30 F	19.5 - 19.6 Bonding in complex ions; the crystal field model
12/3 M	19.7 - 19.8 The molecular orbital model and biological coordination complexes
12/5 W	Why is blood red? - hemoglobin and oxygen binding
12/7 F	Molecules against malaria