



Chesapeake Bay Governor's School
For Marine and Environmental Science
Warsaw Campus

General Chemistry I and II

2016-2017

Gary Long

Description (CHM 111-112):

This course explores the fundamental laws, theories, and mathematical concepts of chemistry and will cover the structure of matter, the characteristics of the states of matter, types of reactions, thermodynamics, chemical kinetics, equilibrium, and electrochemistry. The lab component of the course, which counts approximately thirty percent of the overall grade, will focus on qualitative and quantitative support of the general chemistry concepts. A working knowledge of algebra is required. Applications to environmental phenomena will be emphasized where possible.

Course Credit: 1 high school credit (4 college credits per semester), including lab.

Text:

Chemistry: The Central Science, Brown, LeMay, and Bursten, (Prentice Hall, 2015)

Contact information:

Office: 804-333-1306

Cell: 757-561-8392 (Emergencies only)

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I am normally available at CBGS from 7:30 AM to 3:00 PM. If you need tutoring, you may either stay after CBGS classes, use online resources or make arrangements for me to meet with you at the home high school. Please discuss this with me to ensure appropriate transportation and other issues are covered. See page 15 of the handbook.

Feel free to email me with questions from the homework or with questions about concepts as you study. You may check Schoology for announcements, homework, and any PowerPoints we may be using.

Required Materials: graphing calculator, 3-ring binder with dividers, spiral notebook for homework, lab notebook of bound composition type, preferably quadrille.

Attendance: You are required to arrive on time and attend class every day. CBGS faculty or administrative assistant will contact the student's home if we have not been notified prior to the start of the academic day. **In the event of five (5) or more absences in a marking period, a parent conference will be requested.**

Individual and Group work: Unless specifically indicated, all work is to be done individually and each student must turn in their own assignment. When group work is assigned, one assignment per group is to be turned in unless otherwise specified.

Turning in work: Unless otherwise noted, class work, quizzes and tests are due at the end of the class period in which they were assigned. Homework (including papers, labs, and other projects) are due at the beginning of class on the due date. Many assignments can be emailed to me, but when specified, hard copies must be brought in. If you do not have email access, bring it in on a USB drive, but make sure it is on my computer before class starts. When submitting assignments electronically, all files must be labeled as lastname_firstname_assignment and the subject line of emails must include the assignment name. Attachments or emails that do not fit these criteria may not be read; assignments can be resubmitted, but will be considered late. As always, please come to me with any issues you have.

Late & Make-Up Work: All assignments are expected to be turned in on the day they are due. Assignments turned in late will receive a 10% deduction of the earned grade for every day that they are late; however, homework and daily work that are vital to that day's class participation will not be accepted late (pre-labs, readings for class discussion, etc.). **After 1 week assignments will not be accepted.** Exceptions for extenuating circumstances can be made, but you **MUST** talk to me in advance if possible.

It is the student's responsibility to collect any missing work while absent. Check the website for any assignments, secure any missed notes from a friend, and be sure to get any handouts and assignments from me. Assignments, tests, and projects due on the date of the absence are due upon return to school. If an assignment was due via email or other electronic format, it is still due if you aren't present. Work assigned while absent is due within two days of returning to school. Again, exceptions for extenuating circumstances can be made, but you **MUST** talk to me in advance if possible.

Honor Code: Students are expected to follow the rules and procedures as outlined in the Student Honor Code. Please refer to the Student Handbook if you need guidelines. Failure to do so may result in dismissal from the course. All tests are pledged.

Emergency Evacuation Plan: In each classroom, laboratory or other places where students are assembled for the purpose of instruction, a fire evacuation plan will be posted indicating the direction of travel from the room in the event it becomes necessary to evacuate the building as a result of fire or other emergency.

This plan will be posted in a conspicuous place near the exit from the room. Whenever the fire alarm sounds, the building will be evacuated. The instructor will ensure the fire door is closed upon leaving the area (doors with automatic closures on them). Instructors are also responsible for assisting disabled students.

If a classroom does not have an evacuation plan posted, the student or instructor should notify the academic dean.

Learning Sequence:

Chem 111: 1st Quarter

Unit 1: Introduction to Matter and Measurement

SI System

Laboratory Safety

Laboratory Equipment and Use

Data Analysis: Graphing

Accuracy and Precision

Dimensional Analysis (unit analysis)

Classification of matter: physical vs chemical properties; physical vs chemical changes; intensive vs extensive physical properties

Unit 2: Introduction to Atomic Theory

Brief history of the discovery of atomic structure

Structure of the atom

Use the Periodic Table to define groups (families), and periods and what each represent

Identify and describe the formation of ions

Identify isotopes

Radioactivity: radioactive decay
and half-lives

Calculate average atomic mass

Nomenclature: Use the IUPAC system of chemical nomenclature. Name ionic and molecular substances and translate names into chemical formulas.

Unit 3: Stoichiometry

Use the Law of Conservation of Mass

Quantify Avogadro's number and the concept of "the mole"

Calculate atomic, molecular, formula, and molar mass

Calculate percent composition

Write and balance chemical equations

Identify types of chemical reactions

Calculate theoretical yield and percent yield

Determine the limiting reactant in a reaction

Calculate the empirical formula for an unknown

2nd Quarter

Unit 4: Solution Chemistry (Solutions I, Redox, and Solutions II)

Concentration in Molarity

Identify strong and weak electrolytes and non-electrolytes

Use solubility rules

Write Net Ionic Equations

Neutralization reactions; Acids, bases, and salts

Assigning Oxidation States

Oxidation/Reduction Reactions

Balancing Redox reactions

Define colligative properties

Acids, bases

Unit 5: Thermodynamics I

First and Second Laws of Thermodynamics

Heat capacity and specific heat

Work vs heat

ΔE vs ΔH (Enthalpy)

Hess's Law

Use enthalpies of formation to calculate heats of reaction

Calorimetry in the lab and on problems

Chem 112

3rd Quarter

Unit 6: Modern Atomic Theory

The nature of light

Quantum theory and the atom

Electron configurations

Predict electron configurations from the periodic table

Unit 7: Periodic Properties and Chemical Bonding

Describe periodic atomic properties on the basis of effective nuclear charge, shielding effect, and atomic radius

Lewis dot models for atoms and Lewis structures for molecules and polyatomic ions

Ionic bonds, lattice energy, and compare lattice energies for various ionic compounds

Covalent bond

Define electronegativity and use it to predict whether a covalent bond will be polar or non-polar

VESPR Theory to describe and predict molecular geometry

Orbital hybridization

Sigma bond and a pi bond

Delocalized electrons and resonance

Unit 8: Kinetic Molecular Theory of Matter: Gases

Properties of gases

Gas laws

Define Dalton's Law of Partial Pressures and calculate partial pressures of gases

Graham's Law of Effusion

Ideal gas vs real gas

4th Quarter

Unit 9: The Kinetic Molecular Theory of Matter: Liquids and Solids

Types of intermolecular forces

Explain phase changes using energy and intermolecular forces

Pressure, temperature, and volume to investigate states of matter and phase changes

Enthalpy Curves

Phase diagrams

Vapor pressure

Unit 10: Chemical Equilibrium

Concept of a dynamic equilibrium (3.f)

Writing an equilibrium expression for both homogeneous and heterogeneous equilibria

Calculate the equilibrium constant using pressure data or concentration data

Convert between K_c and K_p

Use a "RICE" chart

Evaluate the significance of equilibrium constants

Discuss the effects of changes to the equilibrium position using LeChâtelier's Principle

Calculate solubility and the solubility product constant, K_{sp} (*)

Discuss and use the common-ion effect (*)

Unit 11: Acid/Base Equilibria

Arrhenius, Brønsted-Lowry, and Lewis theory

pH scale

Calculate pH, pOH, $[H^+]$, and $[OH^-]$

Identify and discuss Acid-Base reactions

Discuss Acid-Base equilibria

Discuss Buffers and use the Henderson-Hasselbalch Equation

Evaluate various Acid/Base titrations

Unit 12: Chemical Kinetics

Identify and discuss factors affecting reaction rates

Use data to write rate laws for reactions

Determine the order of a reaction

Discuss reaction mechanisms

Discuss the effects of adding catalysts

Discuss the effect of temperature and use the Arrhenius Equation to calculate Activation Energy

Unit 13: Environmental Chemistry (Example Below)

Toxic Chemicals in the Environment

PBS Movie: "Poisoned Waters"

Pharmaceuticals

Endocrine disrupting chemicals (EDC)

PBL activity online: "Tuna for Lunch" (methyl-mercury in environment)

Course Expectations:

- 1. ALWAYS DO YOUR BEST!**
- 2. RESPECT!** For yourself, others in the room, the room and all equipment and materials, everyone we deal with, the environment.....!
- 3. SAFETY!** Be aware of yourself and your surroundings in all lab situations.
- 4. Class Participation:** You will get the most out of this class if you come prepared each day and participate in the discussions and other activities. Cell phones must be silenced and placed in the organizer and retrieved at the end of class. If it is needed for class, I will direct you when you may use it. Smart watches are not allowed during tests and quizzes.
- 5. Note Taking:** You will need a notebook for the notes you will take in class as well as the notes you *should* take as you read each chapter. It is wise to learn now how to take detailed notes during class discussions. **Note Making:** You will need to stop periodically to review your notes (at least at the end of each chapter). Summarizing your notes in this way is an excellent way to study, and, if you do it nightly, it will point out questions you need to ask the next day in class.
- 6. Laboratory:** Lab work is an integral part of Chemistry. We will do approximately two labs per month. These labs are of College/Advanced Placement design and quality and as such are long, involved, require data analysis and manipulation, and formal and informal lab reports will be written. Therefore, you will need a separate lab notebook for data collection and reporting. It needs to be of the bound composition book/quadrille type. Your own personal involvement and performance on lab day will be part of your grade for the lab.
- 7. Evaluation:** Formal evaluations (i.e. tests!) will be part multiple choice in format and part free response. Multiple Choice items will come from SATII or AP Tests among other sources so that you will constantly be challenged to use that grey matter. The free response section can be problems, short answers, graphs with data analysis, and/or essays. **You must show your work for full credit.** These will all involve critical thinking skills to prepare you for future scientific endeavors. Evaluations will usually occur at the end of each chapter. Quizzes

will be given often to verify your grasp of concepts or memorization skills (i.e. can you name and write formulas for all of the polyatomic ions!). They are a great tool for troubleshooting and correction.

- 8. Grading:** Grades will be based on homework, quizzes, tests and laboratory work. Grades are assigned as follows:

Homework	10%
Quizzes	25%
Tests	35%
Laboratory	30%

Each semester will include an exam which will be worth 10% of the overall semester grade (independent of the quarterly grade)

The CBGS Grading Scale is listed on page 14 of the handbook.

- 9. Homework:** Doing homework in chemistry provides the practice you need to succeed. Plan on homework every night. We will review homework the following class and we will put some of these on the board when we go over them in class. I will do a quick notebook check to determine if you have done them. You will start each quarter with 100 points for homework. You must attempt 75% showing complete work for credit. For each time you are below 75% your homework grade will be reduced by 10 points (no late homework accepted although exceptions for extenuating circumstances can be made, but you **MUST** talk to me in advance if possible). Chemistry is not like biology with factual memorization (even though there is some memorization). Practice is the only way to master the processes and concepts. I know that concept mastery is what you are interested in this year in Chemistry (!). Developing your powers of logical thinking and problem solving skills is, of course, one of your major goals in this class!

You must have a section in your notebook or a separate spiral bound notebook designated for homework. In the upper right hand corner of the page indicate the date, the page, the assignment and the problem numbers you are doing. Please keep these pages in chronological order to facilitate homework checks in class. I will not spend a great deal of time at each notebook searching for a particular problem set. Write legibly. If I can't read it, I won't grade it.

College Entrance Exams:

Following the completion of this course you will be prepared to take several types of exams. First and foremost is the SOL Chemistry test in May, which you are all required to take unless you already took it at your home school. The second is the SAT II in

Chemistry, the achievement test that can be taken the first Saturday in June. If the college of your choice requires you to take SAT II's, you should try to take this test at the end of this year. I am willing to review with you in May.

Tips on how to survive a college level course:

- Keep up to date.
- Realize that you will have to work/read on weekends and holidays. You should spend about 5 hours a week outside of class on Chemistry. Lab analysis will require more time.
- ***Get organized!***
- Get a 3-ring binder and dividers.
- Sharpen your critical reading, note taking, and essay writing skills.
- Schedule your time and use it effectively!
- ***Practice, practice, practice*** on those problems!

Inclement Weather and School Closings Policy

See page 5 of the handbook. In the event of closure monitor schoology for assignments, lectures, problem solving, etc. We must do our best to keep on track!

CBGS Statement on Safety:

What to know and do to be prepared for emergencies at CBGS/RCC:

- Sign up to receive RCC text messaging alerts and keep your information up-to-date
<<https://alert.rappahannock.edu/index.php?CCheck=1>>
- Know the safe evacuation route from each of your classrooms. Emergency evacuation routes are posted in campus classrooms.
- Listen for and follow instructions from CBGS/RCC or other designated authorities.
- Know where to go for additional emergency information.
- Report suspicious activities and objects