



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

## **Chemistry**

2016-2017

**Suzanne Moore Nguyen**

### **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 twenty-five 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:** 4 RCC credits per semester, including lab. One high school credit.

### **Text:**

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

### **Contact information:**

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I am available at CBGS from 7:30 AM to 3:00 PM. Feel free to email with questions from the homework or with questions about concepts as you study. Tutoring may be available; please check with your instructor to discuss scheduling. Sooner is better than later! 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 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 will not be read; assignments can be resubmitted, but may be penalized as the year progresses. 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 email Mrs. Nguyen first.

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 Mrs. Nguyen first.

**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.

## **Learning Sequence:**

### **Chem 111:**

#### **1<sup>st</sup> 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

#### **2<sup>nd</sup> 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  
 $\Delta E$  vs  $\Delta H$  (Enthalpy)  
Hess's Law  
Use enthalpies of formation to calculate heats of reaction  
Calorimetry in the lab and on problems

## **Chem 112 3<sup>rd</sup> 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  
VSEPR 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

## 4<sup>th</sup> 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

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)

## Course Expectations:

1. **RESPECT!** For yourself, others in the room, the room and all equipment and materials, everyone we deal with, the environment.....!
2. **SAFETY!** Be aware of yourself and your surroundings in all lab situations.
3. **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.
4. **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.
5. **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.
6. **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.

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

Homework	10%
Quizzes	20%
Tests	35%
Final exam (cumulative)	10%
Laboratory	25%

**Regrades:** In the interest of student concept mastery, errors on major tests may be corrected and resubmitted. Students may use any available resource to answer missed questions, including collaboration with classmates. The source of help should be documented on the resubmission e.g. I worked with Ryan Nguyen and Sarah Moore. We consulted our notes, the textbook and the internet. Specific websites are not necessary, but may prove helpful when studying for the final. Students will earn  $\frac{1}{4}$  point for the corrections e.g. you missed a 10 point problem, but successfully reworked it. I will add 2.5 points to your test grade. Regrades must be submitted within one week of the returned item.

8. **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 each time you are below 75% your homework grade will be reduced by 10 points. 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!