MOREHOUSE COLLEGE

CHEM 111 – ELEMENTARY INORGANIC CHEMISTRY I (HOPPS SCHOLARS)
LECTURE
COURSE REQUIREMENTS
LINKED COURSE WITH SOCIAL PROBLEMS (SOC 103)
VIRTUAL REALITY | INTELLECTUAL PROPERTY
FALL 2021

Class Time: MWF 10:00 – 10:50 am **Lecture Room:** Zoom Classroom

Professor: Dr. Muhsinah L. Morris **Office:** Merrill Hall 104/Ste. 105A

Phone: 470-639-0443 **e-mail:** muhsinah.morris@morehouse.edu
Cell Phone: 404-290-0361

Office Hours: WF 12-1 pm; Otherwise, by appointment only.

OBJECTIVE: To familiarize students with fundamental principles and topics of elementary general chemistry and its applications.

DESCRIPTION: This is an instructional, lecture-based course in general chemistry for those whose majors or areas of interest are in science, engineering and other technology related fields.

REQUIREMENTS: CHEM 111R (recitation) and CHEM 111L (laboratory) are co-requisites for this course. The Department will confirm the co-requisites for each student in this class. If a student is found to not have the proper prerequisites and co-requisites, they will be immediately and involuntarily withdrawn from the course, regardless of time spent in the course or performance in the course. If you believe that you do not have the proper prerequisites and co-requisites, or you have questions regarding the prerequisites and co-requisites, you should notify your instructor immediately.

TEXT & MATERIALS: The textbook for this course Chemistry, *Steven S. Zumdahl, Susan A. Zumdahl, and Donald J. DeCoste*, 10th edition, Brooks Cole. ISBN-10: 1305957407 ISBN-13: 9781305957404 . The instructor, when appropriate, will provide supporting materials and handouts. This class will also be using CHEM101, an app for problem sets and quizzes. There is an OER book connected to the app which will be a resource as well.
IP Textbook: *The Intangible Advantage: Understanding Intellectual Property in the New Economy,* by David Kline, The Michelson 20MM Foundation, Inc. 2016.

COURSE PRESENTATION: Course presentation will be in the form of lectures, demonstrations, and presentations. Lectures will consist of reviews from previous readings and lots of problem solving. Make sure to bring notes, problem sets, a scientific calculator, and additional questions to lecture each class period.

ATTENDANCE: Morehouse College attendance rules will be enforced. The student is REQUIRED to be on time for the class. Any student who is more than *five minutes late will not be allowed to attend the class*. Any student who exceeds three unexcused absences will be withdrawn from the course. Students are expected to attend all class meetings. In the event of absence, it is the student's responsibility to obtain assignments and information covered during the absence. It is also the student's responsibility to complete withdrawal through the Office of the Registrar in the event that this becomes necessary. Students should also plan to arrive to class **on time**. The instructor reserves the right to deny classroom entry of tardy students. Withdrawal from lecture automatically requires withdrawal from the lab and vice versa. Attendance is taken each class period and required. The attendance will be entered into Starfish and flags will notify your advisors, instructors, and administration of any lapse in attendance. Attendance does affect your financial aid.

COURSE DESCRIPTION AND GRADING: Students must earn a grade of C or better to pass the course. If a student receives a grade of C- or less, they will not be allowed to register in the next course in the chemistry sequence. All grades are final! No adjustments to grades will be made after the close of semester, except for the grade of incomplete, I (see below). There will be four-hour exams and the final exam. The final exam is required. **No make-up exams will be given without an official College excuse**. The course grade is obtained by averaging the **three highest hour exams and the final exam**, which weighs twice as heavily as an individual hour exams. If one of the class exams is missed that exam becomes the dropped exam. The grading scale is as follows:

100-93	A+
89-92	A
85-88	A-
82-84	B+
79-82	B
75-78	B-
72-74	C+
69-72	C
65-68	C-
60-64	D+

55-59	D
50-54	D-
0-50	F

Quizzes	25%
Problem Sets	15%
Exams	35%
Final Exam	25%

Evaluation Scale

INCOMPLETE: A grade of incomplete will be given only when a student has completed the majority of the course requirements, as specified by the instructor and provide a written excuse, signed by the appropriate university official excuse (e.g., Dean of Students, Division Dean, etc.) indicating a legitimate reason for not completing the course by the close of semester, is provided by the Vice President of student affairs. The student must complete the required course work in the next semester on or before the date indicated by the Registrar's Office or the grade will be converted into an "F".

ACADEMIC HONESTY: The College's policy on academic honesty will be strictly enforced. Cheating on homework, quizzes, and examinations will not be tolerated and will result in a grade of zero on the assignment for the first offense, and in immediate involuntary withdrawal from the course with a failing grade, for a second offense. Plagiarism is a violation of the Honor Code and will be punished with a grade of zero on the assignment for the first offense and a grade of "F" on the course for the second offense. Cheating and plagiarism will not be tolerated. Cheating or plagiarism will result in a zero for the exam or paper. A second offense will result in an F grade and be reported to the student court.

DISRUPTIVE ACTIONS: Students are expected to act with respect for the professor and fellow students. If late, enter and take a seat quietly. Talking to others in the class during lecture/discussion prevents others from hearing the proceedings. Leaving class during session is disruptive and should occur only in an emergency. Disruptive persons will be warned.

TIME REQUIREMENTS: The amount of time outside of class needed to be successful in this class varies with background, study skills, interest, motivation,

and intellectual ability. To be successful, expect 8 or more hours per week outside of class to study and do homework. Students must develop skill in solving problems and this can only be obtained by doing the homework. The laboratory component is separate and requires additional time. Expect approximately 3 hours at home to prepare for lab sessions, calculate results, and prepare reports. Careful attention and good use of class time can reduce the time required outside of class.

PROBLEM SETS AND QUIZZES: Problem sets and other homework will be completed and autograded on the CHEM 101 app. Quizzes will be given regularly and are generally announced. These will also be taken on the CHEM 101 app. There may be unannounced "pop" quizzes in class or quizzes will be taken in the first 5 minutes of class using the CHEM 101 app. It is recommended that you form a study group with classmates that will meet regularly.

DISABILITIES AND IMPAIRMENTS: Morehouse College is an equal opportunity employer and educational institution. The College makes reasonable accommodations for all qualified individuals with disabilities. Any student requesting academic accommodations based on his disability is required to register with our Student Counseling & Student Accessibility Services Center (the "Center") by emailing SAS@morehouse.edu every semester. A disability accommodation letter can be obtained from the Center.

DISCLAIMER: The syllabus is not a contract between the instructor and the student, but rather a guide to course procedures. The instructor reserves the right to amend the syllabus when conflicts, emergencies or circumstances so dictate. In such cases, students will be duly notified. Similarly, the instructor reserves the right to alter the course content and assignments based on new materials, class discussions, or other legitimate pedagogical objectives.

EDUCATIONAL OUTCOMES: At the end of this lecture course, students should be able to:

CHAPTER ONE: CHEMICAL FOUNDATIONS

Section One: To appreciate the importance of creative problem solving.
Section Two: To identify the principal operations and limitations of the scientific method. Section Three: To describe the SI system of units and prefixes.
Section Four: To identify causes of uncertainty in measurement. To show how significant figures are used. To compare precision and accuracy in measurement.
Section Five: To show how to determine the number of significant figures in a calculated result.
Section Six: To show a general method of solving problems.
Section Seven: To show how to convert units between the English and metric systems. Section Eight: To demonstrate conversions among the Fahrenheit, Celsius, and Kelvin temperature scales.
Section Nine: To illustrate calculations involving density.
Section Ten: To show how matter can be classified into subgroups.

CHAPTER TWO: ATOMS, MOLECULES, AND IONS

Section One: To give a brief account of early chemical discoveries.
Section Two: To describe and illustrate the laws of conservation of mass, definite proportion, and multiple proportions.
Section Three: To describe Dalton's theory of atoms and show the significance of Gay-Lussac's experiments.
Section Four: To summarize the experiments that characterized the structure of the atom. Section Five: To describe features of subatomic particles.
Section Six: To introduce basic ideas of bonding in molecules. To show various ways of representing molecules.
Section Seven: To introduce various features of the periodic table.
Section Eight: To demonstrate how to name compounds given their formulas and to write formulas given their names.

CHAPTER THREE: STOICHIOMETRY

Section One: To give a brief account of early chemical discoveries.
Section Two: To describe and illustrate the laws of conservation of mass, definite proportion, and multiple proportions.
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Section Four: To summarize the experiments that characterized the structure of the atom. Section Five: To describe features of subatomic particles.
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Section Seven: To introduce various features of the periodic table.
Section Eight: To demonstrate how to name compounds given their formulas and to write formulas given their names.

CHAPTER FOUR: CHEMICAL REACTIONS AND SOLUTION STOICHIOMETRY

Sections 1-10: Students should be able to:
Name compounds and write formulas for binary compounds, ternary compounds (those with polyatomic ions), and acids.
Memorize the chemical formulas and charges of the polyatomic ions and the most common transition metal ions.
Classify reactions by type.
Write balanced molecular equations, complete ionic equations, and net ionic equations.
Predict if a precipitate will form (Solubility rules; Focus specifically on: that ALL Na+, K+, NH4+, and NO3- salts are soluble)
Perform calculations with different solution concentrations such as molarity and dilution.
Describe how to prepare solutions and to use titration data to determine the molarity (concentration) of solutions.
For reactions in solution, given the molarity and the volume of the reactants, calculate the amount of product produced or the amount of reactant required to react.
Identify a reaction as oxidation-reduction based on evidence of electron transfer and balance the reaction equation.
Predict products of reactions given the chemical names of the reactants.

CHAPTER FIVE: GASES

Section One: To demonstrate atmospheric pressure and explain how barometers work. To define the various units of pressure.
Section Two: To describe certain laws that relate the volume, pressure, and temperature of a gas and to do calculations involving these laws.
Section Three: To define the ideal gas law. To show how to do calculations involving the ideal gas law.
Section Four: To define the molar volume for an ideal gas. To define STP. To show how to do stoichiometric calculations for reactions involving gases. To show how to calculate molar mass from gas density.
Section Five: To state the relationship between partial pressures and total pressure and between partial pressure and mole fraction. To show how to obtain the molecular formula, given the empirical formula and the molar mass.
Section Six: To present the basic postulates of the kinetic molecular theory. To define temperature. To show how to calculate and use root mean square velocity.
Section Seven: To describe effusion and diffusion. To show the relationship between effusion and diffusion.
Section Eight: To describe how real gases deviate from ideal behavior. To show how van der Waals's equation allows for real conditions.
Section Nine: To characterize several real gases.
Section Ten: To characterize the composition of the atmosphere. To describe some of the chemistry of air pollution.

CHAPTER SEVEN: ATOMIC STRUCTURE AND PERIODICITY

Section One: To characterize electromagnetic radiation in terms of wavelength, frequency, and speed.
Section Two: To introduce the concept of quantized energy. To show that light has both wave and particulate properties. To describe how diffraction experiments were used to demonstrate the dual nature of all matter.
Section Three: To show that the line spectrum of hydrogen demonstrates the quantized nature of the energy of its electron.
Section Four: To describe the development of the Bohr model for the hydrogen atom. Section Five: To show how standing waves can be used to describe electrons in atoms. To describe the Heisenberg uncertainty principle. To explain the significance of electron probability distributions.
Section Six: To explain the quantum numbers n, l, and ml.

Section Seven: To describe the shapes of orbitals designated by s, p, d, and f and to discuss orbital energies.
Section Eight: To define electron spin and the electron spin quantum number. To explain the Pauli exclusion principle.
Section Nine: To show how the quantum mechanical model can be applied to atoms besides hydrogen.
Section Ten: To trace the development of the periodic table.
Section Eleven: To explain the Aufbau principle.
Section Twelve: To show general trends in ionization energy, electron affinity, and atomic radius in the periodic table.
Section Thirteen: To show what types of information can be obtained from the periodic table.

CHAPTER EIGHT: BONDING: GENERAL CONCEPTS

Section One: To explain why an ionic bond is formed. To explain why a covalent bond is formed. To introduce the polar covalent bond.
Section Two: To discuss the nature of a bond in terms of electronegativity.
Section Three: To define the relationship between bond polarity and molecular polarity. Section Four: To show how to predict the formulas of ionic compounds. To discuss the factors governing ion size.
Section Five: To define lattice energy and show how it can be calculated.
Section Six: To show the relationship between electronegativity and the ionic character of a bond.
Section Seven: To discuss the covalent bonding model.
Section Eight: To show how bond energies can be used to calculate heats of reaction. Section Nine: To introduce the localized electron model.
Section Ten: To show how to write Lewis structures.
Section Eleven: To show how to write Lewis structures for certain special cases.
Section Twelve: To illustrate the concept of resonance. To show how to write resonance structures.
Section Thirteen: To describe how molecular geometry can be predicted from the number of electron pairs.

CHAPTER NINE: COVALENT BONDING: ORBITALS

Section One: To show how special atomic orbitals are formed in covalent bonding. Section Two: To show how molecular orbitals are formed in a molecule. To define bond order and demonstrate how to calculate it.
Section Three: To discuss the bonding in certain molecules of the general formula X2. To relate paramagnetism to the filling of molecular orbitals. To correlate bond order, bond energy, and bond length.
Section Four: To use the molecular orbital model to treat bonding between two different atoms.
Section Five: To show how the need for resonance is eliminated if the localized electron and molecular orbital models are combined.
Section Six: To show how photoelectron spectroscopy (PES) can be used to give information about the energies of electrons in molecules.

INTELLECTUAL PROPERTY

Learning Objectives:
At the end of this course, students should be able to do the following:
1. Demonstrate an understanding of the different categories of intellectual property.
2. Identify the requirements that make an invention eligible for patent protection.
3. List the creative works that are eligible for copyright protection.
4. Outline the benefits of trademark protection.
5. Analyze the criteria for establishing trade secret protection and the significance of the secrecy requirement.

Student Learning Outcomes:
1. Given a set of facts, students will be able to identify which works are eligible for copyright protection.
2. Presented with a hypothetical fact pattern, students will be able to align different types of subject matter with the appropriate form of intellectual property protection.
3. Students will be able to demonstrate a level of engagement in the subject matter that reveals their understanding of the value of the course content beyond the task itself, specifically as it relates to linking the relevance of course content to careers in business and their personal lives.

TENTATIVE LECTURE AND EXAM SCHEDULE (Subject to Change)

Date	Read Chapters	Topic	Notes
18-Aug		1st Day of Class Syllabus Review and Expectations	Personality Test Assignment and Discussion Board
20-Aug	**Chapter 1 Chemical Foundations**	Scientific notation, significant figures, SI units and conversions	Element Quiz #1 Periodic Table of Elements #1-20
23-Aug	**Chapter 1 Chemical Foundations**	Problem solving and dimensional analysis, Temperature, density, the Mole and Avogadro's number	
25-Aug	**Chapter 2 Atoms, Molecules and Ions**	The Early History of Chemistry, Fundamental Chemical Laws, Dalton's Atomic Theory, Early experiments to characterize the atom, The modern view of atomic structure: An Introduction	Element Quiz #2 Periodic Table of Elements #21-56
27-Aug	**Chapter 2 Atoms, Molecules and Ions**	Molecules and Ions, An Introduction to the Periodic Table	Quiz #1-Chapter 1
30-Aug	**Chapter 2 Atoms, Molecules and Ions**	Naming Simple Compounds	
1-Sept	**Chapter 3 Stoichiometry**	Counting by weighing, Atomic masses, The Mole, Molar Mass, Learning to Solve Problems, Percent Composition of Compounds	
3-Sept		The Mole, Molar Mass, Learning to	Quiz #2-Chapter 2

		Solve Problems, Percent Composition of Compounds Percent Yield	
6-Sept		***NO CLASS Labor Day***	
8-Sept	**Chapter 3 Stoichiometry** Chapter 3-10 Chapter 3-11	Stoichiometric Calculations: Amounts of reactants and Products, The concept of limiting reagent	
10-Sept	***Intro to Intellectual Property***		Quiz #3-Chapter 3
13-Sept	***Chapters 1, 2, and 3***	***Exam #1***	
15-Sept	***VR Experience***	***Course Tour***	
17-Sept	**Chapter 4 Types of Reactions and Solution Stoichiometry** Chapter 4-1 Chapter 4-2 Chapter 4-3	Water, the Common Solvent, The Nature of Aqueous Solutions: Strong and Weak Electrolytes, The Composition of Solutions	
20-Sept	**Chapter 4 Types of Reactions and Solution Stoichiometry** Chapter 4-4 Chapter 4-5 Chapter 4-6 Chapter 4-7	Types of Chemical Reactions, Precipitation Reactions, Describing Reactions in Solution, Stoichiometry of Precipitation Reactions	
22-Sept	**Chapter 4 Types of Reactions and Solution Stoichiometry** Chapter 4-8 Chapter 4-9 Chapter 4-10	Acid-Base Reactions (Neutralization Reactions), Oxidation-Reduction Reactions (redox), Balancing Oxidation-	

		Reduction Equations	
24-Sept	**VR Experience Patents; Trademarks**	Module 1 Discussion Board: IP	Quiz #4-Chapter 4
27-Sept**	**Chapter 5 Gases** Chapter 5-1 Chapter 5-2 Chapter 5-3	Pressure, The Gas Laws of Boyle, Charles, and Avogadro, The Ideal Gas Law	
29-Sept	Chapter 5-4 Chapter 5-5	Gas Stoichiometry; Dalton's Law of Partial Pressures	
1-Oct	Chapter 5-6 Chapter 5-7 Chapter 5-8	Effusion and Diffusion; Real Gases; Characteristics of Several Real Gases	Quiz #5-Chapter 5
4-Oct	***NO CLASS***	***FALL BREAK***	***NO CLASS***
6-Oct	***Chapters 4 and 5*** **VR Experience**	***Exam #2*** Module 2 Part I	
8-Oct	**Chapter 7 Atomic Structure and Periodicity** Chapter 7-1 Chapter 7-2	Electromagnetic radiation, The nature of Matter,	
11-Oct	Chapter 7-3 Chapter 7-4	The atomic spectrum of hydrogen; The Bohr Model	
13-Oct	Chapter 7-5 Chapter 7-6 Chapter 7-7 Chapter 7-8	The Quantum Mechanical Model of the Atom, Quantum Numbers Orbital shapes and energies, Electron Spin and Pauli Principle	
15-Oct	Chapter 7-9 Chapter 7-10 Chapter 7-11	Polyelectronic atoms, The history of the periodic table, The Aufbau Principle and the Periodic Table	
18-Oct	Chapters 7-12	Periodic Trends in	

	Chapters 7-13	Atomic Properties, The Properties of a Group: Alkali Metals	
20-Oct	VR Experience	Module 3	Quiz #6-Chapter 7
22-Oct	***IP: Copyright, Trade Secrets*** ***Chapter 7***	***IP Survey*** ***Exam #3***	
25-Oct	**Chapter 8 Bonding: General Concepts** Chapter 8-1 Chapter 8-2	Types of Chemical Bonds, Electronegativity	
27-Oct	Chapter 8-3 Chapter 8-4	Bond Polarity and Dipole Moments; Ions: Electron Configurations and Sizes	
29-Oct	Chapter 8-7 Chapter 8-8	The Covalent Chemical Bond: A Model, Covalent Bond Energies and Chemical Reactions	
1-Nov	Chapter 8-9 Chapter 8-10 Chapter 8-11	The Localized Electron Bonding Model, Lewis Structures, Exceptions to the Octet Rule	
3-Nov	Chapter 8-12 Chapter 8-13	Resonance, Molecular Structure: The VSEPR Model	
5-Nov	**IP Overview**	Discussion Board 2: IP	Quiz #7 Chapter 8
8-Nov	**VR Experience**	Module 4 Part I	
10-Nov	**VR Experience**	Module 4 Part II	
12-Nov	**Chapter 9 Covalent Bonding: Orbitals** Chapter 9-1 Chapter 9-2	Hybridization and the Localized Electron Model, The molecular Orbital Model	
15-Nov	Chapter 9-3	Bonding in Homonuclear Diatomic Molecules,	

17-Nov	Chapter 9-4	Bonding in Heteronuclear Diatomic Models	
19-Nov	Chapter 9-5	Combining the localized electron and molecular orbital models	
22-Nov	Chapter 9-6	Photoelectron spectroscopy	
24-Nov		***Thanksgiving Holidays***	***NO CLASS***
26-Nov		***Thanksgiving Holidays***	***NO CLASS***
29-Nov	Chapters 1-3, 6-9	Exam Review; Final Exam Study Review	Quiz #8-Chapter 9
1-Dec	***Chapter 9***	***Exam #4***	
2-Dec & 3-Dec		***Reading Period***	**NO CLASS**
Week of 6-Dec	**Chapters 1-5, 7-9**	**Final Examination**	

* Last Day for ADD/DROP is August 24, 2021
** depicts Midterm Examination Week
Last day to withdraw with a grade of W (Monday, October 25)