

Course Syllabus Fall 2018

Chemistry 205: General, Organic, and Biological Chemistry

(CRN: 1394 – Sec: 105)

Department of Chemistry, Marshall University

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Office Hours: By appointment (E-mail)

Credit Hours: 3.00 hours

Course Time and Location: 7.30-9.50 p.m. Wednesday: Seville Building, Teays Valley

Course Description: Introductory course for health professions students and non-science majors covering basic chemical principles with applications in organic chemistry and biochemistry.

Pre-requisites: There are no formal pre-requisites for this course. It is, however, strongly advisable to have a math ACT score above 17 before attempting this course as you will be required to make calculations on a near daily basis.

Required Materials:

- **Text:** The text for this course is The Basics of General, Organic, and Biological Chemistry v2.0.4 By: David W. Ball, John W. Hill, and Rhonda J. Scott; Published: 2018; ISBN: 978-1-4533-9345-1. Versions of the book are available at flatworldknowledge.com ranging from \$29.95 to \$74.95 and ranging from online only to e-book, soft cover printed book and study aids.
- **Calculator:** You will need a basic, non-programmable calculator. You should be able to find a suitable calculator for \$15 or less. Calculators with alphanumeric and/or graphing capabilities are not permitted during quizzes and exams. Additionally, cell phone calculators are completely off limits during quizzes, exams, and during normal lecture periods.

Grading:

Exams:

Exam I	125
Exam II	125
Exam III	125
Exam IV	125

Class Assignment 25pt x 15 Chapter	375
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Attendance	50
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Professor evaluation	50
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Bonus point	25
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Total	1000
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Grading Scale: A: 900-1000; B: 800-890; C: 700-790; D: 600-690; F < 600

Course Curriculum: Lectures and assignments will cover chapters 1 through 19 in the text.

Electronic Device Policy: All cell phones and pagers must be turned to vibrate during class. Recording of lectures without the instructor's permission is prohibited. During examinations, all electronic devices except calculators must be inaccessible. Students **MUST BRING A CALCULATOR** to class for all lectures and exams. Calculators that are part of a cell phone or PDA are not acceptable during an exam or quiz.

University Policies: All university policies, which can be found at this link http://www.marshall.edu/wpmu/academic-affairs/?page_id=802, will be observed.

Important Dates:

First day of classes: Aug. 22

Freshman/Sophomore Midterm grades due: Oct. 20

Last Day to Drop: Oct. 26

Fall Break: Nov. 19-23

The final exam will be given to CHM 205 students on Wed Dec. 5th 7.30-9.30

Approximate Schedule:

Class Date	Chapters/Sections	Topics name	
8/22	Intro, Chapter 1	Matter and Measurement	General Chemistry I
8/29	Chapter 2	Elements, Atoms, and the Periodic Table	
9/5	Chapter 3	Ionic Bonding and Simple Ionic Compounds	
9/12	Chapter 4	Covalent Bonding and Simple Molecular Compounds	General Chemistry II
9/19	Exam I (1-4) Chapter 5, 6,	Intro to Chemical Reactions Quantities in Chemical Reactions	
9/26	Chapter 7, 8	Energy and Chemical Processes Solids, Liquids, and Gases	
10/3	Chapter 9	Solutions	
10/10	Chapter 10	Acids and Bases	
10/17	Exam II (6-10) Chapter 11	Nuclear Chemistry	
10/24	Chapter 12	Organic Chemistry Basic	Organic Chemistry
10/26 Last day to drop an individual course			
10/31	Chapter 13	Carbohydrates	
11/7	Exam III (11-13) Chapter 14	Lipids	Biochemistry
11/14	Chapter 15	Amino Acids, proteins and Enzymes	
11/19- 11/23 Fall Break			
11/28	Chapter 16	Nucleic acids	
12/5	Final Exam (13-16)		

Tentative exam schedule*

Exam	Week of	Chapters
Exam I	9/19	1-4
Exam II	10/17	6-10
Exam III	11/7	11-13
Final Exam	12/5	13-16

CHM 205 Learning Objectives

Chapter 1

- Define chemistry in relation to other sciences.
- Identify the general steps in the scientific method.
- Use chemical and physical properties, including phase, to describe matter.
- Identify a sample of matter as an element, a compound, or a mixture.
- Express quantities properly, using a number and a unit. Express a large number or a small number in scientific notation.
- Identify the number of significant figures in a reported value.
- Use significant figures correctly in arithmetical operations.
- Recognize the SI base units and explain the system of prefixes used with them.
- Convert a value reported in one unit to a corresponding value a different unit.

Chapter 2

- Define a chemical element and give examples of the abundance of different elements.
- Represent a chemical element with a chemical symbol.
- Explain all matter is composed of atoms.
- Describe the modern atomic theory.
- Describe the three main subatomic particles.
- State how the subatomic particles are arranged in atoms.
- Define and differentiate between the atomic number and the mass number of an element.
- Explain how isotopes differ from one another.
- Define atomic mass and atomic mass unit.
- Describe how electrons are grouped within atoms.
- Explain how elements are organized into the periodic table.
- Describe how some characteristics of elements relate to their positions on the periodic table.

Chapter 3

- Define the octet rule.
- Describe how ionic bonds are formed.
- Define the two types of ions.
- Use Lewis diagrams to illustrate ion formation.
- Write the chemical formula for a simple ionic compound.
- Recognize polyatomic ions in chemical formulas.
- Use the rules for naming ionic compounds.
- Determine the formula mass of an ionic compound.

Chapter 4

- Describe how a covalent bond forms.
- Determine the chemical formula of a simple covalent compound from its name.
- Determine the name of a simple covalent compound from its chemical formula.
- Recognize molecules that are likely to have multiple covalent bonds.
- Compare covalent bonds in terms of bond length and bond polarity
- Determine the molecular mass of a molecule.
- Predict the general shape of a simple covalent molecule.

Chapter 5

- Correctly define a law as it pertains to science.
- State the law of conservation of matter.
- Define chemical reaction.
- Use a balanced chemical equation to represent a chemical reaction.
- Calculate the amount of one substance that will react with or be produced from a given amount of another substance.
- Classify a given chemical reaction into a variety of types.

- Identify a chemical reaction as an oxidation-reduction reaction.
- Identify oxidation-reduction reactions with organic compounds.

Chapter 6

- Define the mole unit.
- Learn how the masses of moles of atoms and molecules are expressed.
- Convert quantities between mass units and mole units.
- Use a balanced chemical reaction to determine molar relationships between the substances.
- Convert from mass or moles of one substance to mass or moles of another substance in a chemical reaction.

Chapter 7

- Define energy and heat.
- Relate heat transfer to temperature change.
- Determine the heat associated with a phase change.
- Define bond energy.
- Determine if a chemical process is exothermic or endothermic.
- Relate the concept of energy change to chemical reactions that occur in the body.

Chapter 8

- Define phase.
- Identify the type of interactions between molecules.
- Describe the solid and liquid phases.
- Describe the gas phase.
- Predict the properties of gases using the gas laws.

Chapter 9

- Understand what causes solutions to form.
- Express the amount of solute in a solution in various concentration units.
- Use molarity to determine quantities in chemical reactions.
- Determine the resulting concentration of a diluted solution.
- Describe the dissolution process at the molecular level.
- Describe how the properties of solutions differ from those of pure solvents.

Chapter 10

- Recognize a compound as an Arrhenius acid or an Arrhenius base.
- Recognize a compound as a Brønsted-Lowry acid or a Brønsted-Lowry base.
- Illustrate the proton transfer process that defines a Brønsted-Lowry acid-base reaction.
- Write chemical equations for water acting as an acid and as a base.
- Describe the difference between strong and weak acids and bases.
- Describe how a chemical reaction reaches chemical equilibrium.
- Define the pH scale and use it to describe acids and bases.
- Define buffer and describe how it reacts with an acid or a base.

Chapter 11

- Define and give examples of the major types of radioactivity
- Define half-life
- Determine the amount of radioactive substance remaining after a given number of half-lives.
- Express amounts of radioactivity in a variety of units.
- Learn some applications of radioactivity
- Explain where nuclear energy comes from.
- Describe the difference between fission and fusion

Chapter 12

- Define organic chemistry.
- Identify organic molecules as alkanes, alkenes, alkynes, alcohols, or carboxylic acids.
- Recognize the composition and properties typical of organic and inorganic compounds.

- Identify and name simple (straight-chain) alkanes given formulas and write formulas for straight-chain alkanes given their names.
- Learn how alkane molecules can have branched chains and recognize compounds that are isomers.
- Write condensed structural formulas for alkanes given complete structural formulas. \
- Draw line-angle formulas given structural formulas.
- Name alkanes by the IUPAC system and write formulas for alkanes given IUPAC names.
- Name halogenated hydrocarbons given formulas and write formulas for these compounds given names
- Name cycloalkanes given their formulas and write formulas for these compounds given their names. Name alkenes given formulas and write formulas for alkenes given names.
- Recognize alkenes that can exist as cis-trans isomers.
- Classify isomers as cis or trans.
- Draw structures for cis-trans isomers given their names
- Write equations for the addition reactions of alkenes with hydrogen, halogens, and water.

Chapter 13

- Recognize carbohydrates and classify them as mono-, di-, or polysaccharides.
- Classify monosaccharides as aldoses or ketoses and as trioses, tetroses, pentoses, or hexoses.
- Distinguish between a D sugar and an L sugar.
- Identify the structures of D-glucose, D-galactose, and D-fructose and describe how they differ from each other.
- Define what is meant by anomers and describe how they are formed.
- Explain what is meant by mutarotation
- Identify the physical and chemical properties of monosaccharides
- Identify the structures of sucrose, lactose, and maltose
- Identify the monosaccharides that are needed to form sucrose, lactose, and maltose
- Compare and contrast the structures and uses of starch, glycogen, and cellulose

Chapter 14

- Recognize the structures of common fatty acids and classify them as saturated, monounsaturated, or polyunsaturated.
- Explain why fats and oils are referred to as triglycerides.
- Explain how the fatty acid composition of the triglycerides determines whether a substance is a fat or oil.
- Describe the importance of key reactions of triglycerides, such as hydrolysis, hydrogenation, and oxidation.
- Identify the distinguishing characteristics of membrane lipids.
- Describe membrane components and how they are arranged.
- Identify the function of steroids produced in mammals.

Chapter 15

- Recognize amino acids and classify them based on the characteristics of their side chains.
- Explain how an amino acid can act as both an acid and a base.
- Explain how a peptide is formed from individual amino acids.
- Explain why the sequence of amino acids in a protein is important.
- Describe the four levels of protein structure.
- Identify the types of attractive interactions that hold proteins in their most stable three-dimensional structure.
- Explain what happens when proteins are denatured.
- Identify how a protein can be denatured.
- Explain the functions of enzymes.
- Explain how enzymes are classified and named.
- Describe the interaction between an enzyme and its substrate.
- Describe how pH, temperature, and the concentration of an enzyme and its substrate influence enzyme activity.

- Explain what an enzyme inhibitor is.
- Distinguish between reversible and irreversible inhibitors.
- Distinguish between competitive and noncompetitive inhibitors.
- Explain why vitamins are necessary in the diet.

Chapter 16

- Identify the different molecules that combine to form nucleotides.
- Identify the two types of nucleic acids and the function of each type.
- Describe how nucleotides are linked together to form nucleic acids.
- Describe the secondary structure of DNA and the importance of complementary base pairing.
- Describe how a new copy of DNA is synthesized.
- Describe how RNA is synthesized from DNA.
- Identify the different types of RNA and the function of each type of RNA.
- Describe the characteristics of the genetic code.
- Describe how a protein is synthesized from mRNA.
- Describe the causes of genetic mutations and how they lead to genetic diseases.
- Explain how viruses reproduce in cells.