

Montgomery County Community College  
CHE 131  
Chemistry for Technology I  
4-3-3

**COURSE DESCRIPTION:**

A general course in physical-inorganic and organic chemistry. Emphasis will be placed on the theoretical and descriptive attributes of chemistry, so as to form a sound basis for the understanding of the analytical and biological chemistry and their application to technology. Laboratory experiments will be performed so as to facilitate an understanding of the chemical principles and experimental techniques developed in the program. This course is subject to a course fee. Refer to <http://mc3.edu/adm-fin-aid/paying/tuition/course-fees> for current rates.

**REQUISITES:**

*Previous course Requirements*

- High School Chemistry or equivalent (e.g., CHE 121 General Chemistry I)

*Concurrent Course Requirements*

None

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Explain basic principles of inorganic-physical chemistry.	Lectures Class Discussions Laboratory Experiments Daily Readings and Problem-Solving Assignments Laboratory Simulations Laboratory Demonstrations	Section Exams Comprehensive Final Exam Laboratory Reports or Analysis
2. Solve quantitative problems in the areas of stoichiometry, states of matter, and solution chemistry.	Lectures Class Discussion Laboratory Experiments Daily Readings and Problem-Solving	Section Exams Comprehensive Final Exam Laboratory Reports or Analysis
3. Utilize the fundamental language of chemistry including formula writing, inorganic nomenclature, and equation writing.	Lectures Class Discussion Daily Readings and Problem-Solving	Section Exams Comprehensive Final Exam

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
4. Perform basic laboratory experiments employing appropriate laboratory techniques.	Laboratory Experiments	Laboratory Reports or Analysis
5. Process and analyze the results of laboratory data gathering.	Laboratory Experiments	Laboratory Reports or Analysis
6. Synthesize the information from various sources in order to solve laboratory or typical chemistry applications problems.	Lectures Class Discussion Daily Readings and Problem-Solving	Laboratory Reports or Analysis Section Exams Comprehensive Final Exam

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria.*

#### SEQUENCE OF TOPICS:

- A. Lecture
1. General introduction to chemistry
    - a) Matter and energy
    - b) Elements, compound, and mixtures
    - c) Symbols for substances
  2. Properties of matter and energy
    - a) Physical properties
    - b) Chemical properties
    - c) Kinetic and potential energy
  3. Introduction to atomic theory
    - a) Dalton model
    - b) Subatomic particles
    - c) Atomic and mass numbers
    - d) Atomic mass
  4. Introduction to inorganic nomenclature
    - a) Salts-main group metals
    - b) Salts-transition metals
    - c) Salts-polyatomic ions
    - d) Acids and bases
    - e) Simple binary molecules

5. Review of basic mathematical calculations employed in chemistry
  - a) Scientific notation
  - b) Significant figures
  - c) Rounding
  - d) Introduction to quantitative problem-solving
    - 1) Factor-label
    - 2) Algebraic formulas
6. Introduction to measurement systems and measurement calculations
  - a) SI system of measurement
  - b) One-step factor-label problems
  - c) Multiple step factor-label problems
  - d) Temperature conversions
  - e) Density, specific gravity, specific heat calculations
7. Introduction to chemical calculations with the mole concept
  - a) The mole and molar mass
  - b) Mole-gram type of conversions
  - c) Percent composition of compounds
  - d) Calculating empirical formulas
  - e) Determination of molecular formulas
8. Chemical reactions and equation writing
  - a) Writing and balancing equations
  - b) Simple types of reactions
  - c) Heat effects during chemical change
9. Stoichiometry calculations
  - a) Mole-mole stoichiometry
  - b) Mole-gram stoichiometry
  - c) Gram-gram stoichiometry
  - d) Multiple step stoichiometry
  - e) Limiting reagent
  - f) Percent yield
10. Atomic theory and the periodic table
  - a) Electromagnetic radiation
  - b) The Bohr atom
  - c) The modern atom
    - 1) s p d f (Electronic distributions) - ground state
    - 2) Orbitals, sublevels, and levels of atomic structure
    - 3) Atomic structure and the periodic table
11. Chemical bonding
  - a) Ionic compounds
    - 1) Ionization, electron affinity, and atomic volume
    - 2) Ion formation
    - 3) Formation of ionic compounds
    - 4) Formulas for ionic compounds
    - 5) General properties of ionic compounds

- b) Covalent compounds
  - 1) Lewis structures-simple elements and inorganic compounds
  - 2) Lewis structures-simple organic
  - 3) Lewis structures-Resonance and Coordinate covalent bonding
  - 4) Lewis structure-Polyatomic ions
  - 5) Lewis structures-exceptions to the octet rule
  - 6) Electronegativity and polar bonds
  - 7) VSEPR and molecular shape
  - 8) Molecular polarity
- 12. States of matter
  - a) General properties of solid, liquids, and gases
  - b) Kinetic-molecular theory
  - c) Gas laws
    - 1) Boyle
    - 2) Charles
    - 3) Combined
    - 4) Dalton
    - 5) Gay-Lussac
    - 6) Avogadro
    - 7) Ideal gas behavior
  - d) Intermolecular Forces and states of matter
    - 1) Dispersion force
    - 2) Dipole-dipole force
    - 3) Hydrogen Bond
  - e) General properties of liquids (water)
- 13. Introduction to solution chemistry
  - a) General properties of solutions and suspensions
  - b) Solubility considerations
  - c) Concentration
    - 1) Percent by mass
    - 2) Percent by volume
    - 3) Molarity
    - 4) Molality
    - 5) Dilution problems
  - d) Colligative properties of solutions
- 14. Ionization theory
  - a) Acid and base models
  - b) Acid and base reactions-neutralization
  - c) Salts
  - d) Electrolytes and nonelectrolytes
  - e) Ionization theory
  - f) Electrolyte strength
  - g) pH
  - h) Colloids

15. Equilibrium and kinetics
  - a) Kinetic factors and collision theory
  - b) Reversible reactions and equilibrium
  - c) Le Chatelier's Principle
  - d) Equilibrium constants
  - e) Ionization and solubility products constants
  - f) Buffers
16. Reduction and oxidation
  - a) Oxidation numbers
    - 1) Use in nomenclature
    - 2) Identifying reducing agents and oxidizing agents
  - b) Electrolytic and Voltaic Cells

B. Laboratory

A minimum of eight laboratory experiments are to be conducted during the semester. The list of experiments (or a reasonable substitute) is indicated below. Additional laboratory activities are strongly recommended. Laboratory experiments can also be obtained from Falcon Chemistry (the computer-based experiments available on the MCCC network) and the Vernier computer technology equipment available in room SC 312.

- 1) Preparation of oxygen
- 2) Reactions Heats (Computer Assisted)
- 3) Lewis structures and molecular models
- 4) Density
- 5) Decomposition of a hydrate
- 6) Decomposition of potassium chlorate
- 7) Double replacement reactions-single replacement rxn
- 8) Chemical Reactions and Chemical Equations

LEARNING MATERIALS:

Textbook:

Hein, Pattison, Arena. (2012). *Introduction to General, Organic, and Biochemistry* (10<sup>th</sup> ed.). John Wiley & Sons, Inc.

Laboratory Manual:

Hein, Peisin, Ritchey. (2012). *Introduction to General, Organic, and Biochemistry in the Laboratory* (10<sup>th</sup> ed.). John Wiley & Sons, Inc.

Student Success Center (College Hall)

LRC (Library) (College Hall)

Computer-based Laboratory (SC 312)

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

## COURSE APPROVAL:

Prepared by: Raymond J. Leary, Professor of Chemistry	Date: 10/23/2004
Revised by: Raymond J. Leary, Professor of Chemistry	Date: 2/5/2009
VPAA/Provost Compliance Verification: Dr. John C. Flynn, Jr.	Date: 9/11/2009

Revised by: Raymond J. Leary, Professor of Chemistry	Date: 6/30/2012
VPAA/Provost or designee Compliance Verification: Victoria L. Bastecki-Perez, Ed.D.	Date: 7/10/2012

Revised by: Debbie Dalrymple	Date: 6/27/2016
VPAA/Provost or designee Compliance Verification: Victoria L. Bastecki-Perez, Ed.D.	Date: 6/27/2016

Revised by: Debbie Dalrymple	Date: 1/10/2018
VPAA/Provost or designee Compliance Verification:	Date: 1/30/2018



*This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.*