

**STATE UNIVERSITY OF NEW YORK  
COLLEGE OF TECHNOLOGY  
CANTON, NEW YORK**

**COURSE OUTLINE**

**CHEM 107 INVESTIGATIVE CHEMISTRY**

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**SCHOOL OF SCIENCE, HEALTH & PROFESSIONAL STUDIES  
SCIENCE DEPARTMENT  
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## CHEM 107 INVESTIGATIVE CHEMISTRY

- A. TITLE: Investigative Chemistry
- B. COURSE NUMBER: CHEM 107
- C. CREDIT HOURS: 3
- D. WRITING INTENSIVE COURSE: No
- E. COURSE LENGTH: 15 weeks
- F. SEMESTER(S) OFFERED: Spring
- G. HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:  
Lecture 3 hours a week

H. CATALOG DESCRIPTION:

This is a basic introduction to chemistry course designed to cover topics and methods used in forensic science. This course will include atomic structure, measurements and conversions, inorganic and organic chemical nomenclature, the mole concept, chemical reactions and stoichiometry, solution chemistry, acid-base theory, physical behavior of gases, calorimetry, chemical kinetics, dynamic equilibrium, and nuclear chemistry. In addition, it will discuss the chemistry of explosions, the nature of drug molecules and how they relate to addiction, as well as the use of DNA in analyzing evidence. It is designed for those students who have little or no chemistry background. Conditions: For students who did not pass the NYS Chemistry Regents exam (<65) or who did not take HS chemistry. Prerequisite: Beginning Algebra (MATH 100) or high school equivalent or permission of instructor. Co-requisite Investigative Chemistry Lab (CHEM 108). A student cannot receive credit for both CHEM 101 and CHEM 107.

I. PRE-REQUISITES/CO-COURSES: Beginning Algebra (MATH 100) or high school equivalent or permission of instructor. Co-requisite: Investigative Chemistry Lab (CHEM 108).

J. STUDENT LEARNING OUTCOMES: Upon completion the student will be able to:

<i>Course Objective</i>	<i>Institutional SLO</i>
1. Describe how forensic science can be used to learn chemistry through case studies prior to each topic; and demonstrate the ability to apply mathematics to scientific concepts, such as conversions, density, percent composition and molar calculations (molar mass, molarity, molality, stoichiometry)	2. Crit. Thinking 3. Prof. Competence
2. Define the general properties of matter and demonstrate how a physical property can be used to analyze evidence; identify atomic and electron structure of elements given their mass and atomic numbers; write formulas for and name compounds (ionic and	2. Crit. Thinking 3. Prof. Competence

covalent) and balance chemical equations and perform calculations relating mass, concentration and molar quantity.	
3. Use the principles of solution chemistry to determine types of solutions including acids and bases, the concentration of solutions, pH, and buffering.	2. Crit. Thinking 3. Prof. Competence
4. Identify intermolecular forces and describe how intermolecular forces affect the physical properties of substances and mixtures. Explain the valence bond theory of covalent bonding and construct Lewis structures of ionic and covalent compounds, and describe how drug molecules interact with neurons.	2. Crit. Thinking 3. Prof. Competence
5. Apply the concepts of thermodynamics to chemical reactions and processes; assign oxidation number, identify reduction and oxidation processes, and perform calorimetric calculations.	2. Crit. Thinking 3. Prof. Competence

K. TEXTS:

Textbook: Johll, Matthew, *Investigating Chemistry a Forensic Science Perspective*, 3<sup>rd</sup> edition, W.H. Freeman and Co. New York, 2012

L. REFERENCES:

M. EQUIPMENT: Students will be required to supply themselves with a scientific calculator that can do logarithms and powers of 10.

N. GRADING METHOD (P/F, A-F, etc.): A-F

O. MEASUREMENT CRITERIA:

Exams and Quizzes  
Assignments  
Final exam or culminating project

P. DETAILED TOPICAL OUTLINE:

1. Introduction to Forensic Chemistry
  - a. Forensic science can be used to learn chemistry
  - b. Elements, compounds and states of matter
  - c. Atomic symbols, the periodic table, and chemical formulas
  - d. The scientific method and critical skill scientists must learn
2. Evidence Collection and Preservation
  - a. Chemical versus physical changes and properties
  - b. Units of measurement, significant figures, conversion factors and density
  - c. How physical property are used to analyze evidence
3. Atomic Clues
  - a. Daltons atomic theory and the modern model of the atom
  - b. Subatomic particles, isotopes, and the electron configuration
  - c. Emission spectra and the behavior of light

4. Chemical Evidence
  - a. The periodic table
  - b. Formula writing and nomenclature for ionic and covalent compounds
  - c. Writing and balancing chemical reactions
  - d. The mole and molar mass
  - e. Types of chemical reactions
  - f. Stoichiometry: the use of balanced chemical equations to determine the relationship between quantities of reactants and products
5. Properties of Solutions I: Aqueous Solutions
  - a. Properties of a solution: solvent and solute
  - b. Solubility of ionic and molecular compound in water
  - c. The effects of temperature, surface area, and concentration on the rate at which a compound dissolves
  - d. Electrolytic and nonelectrolytic solutions
  - e. Saturated, unsaturated and supersaturated solutions
  - f. Precipitation reactions
  - g. Units of concentration
  - h. Acids and bases, the pH scale and buffers
6. Properties of Solutions II: Intermolecular Forces and Colligative Properties
  - a. Intermolecular forces and some properties of liquids
  - b. Freezing point depression and boiling point elevation of solutions
  - c. Osmotic pressure
7. Drug Chemistry
  - a. Skeletal structures of drug compounds
  - b. Lewis dot Structures
  - c. Pharmacology, toxicology, lethal dose and scheduled Drug Numer and Trafficking Penalties
8. Chemistry of Addiction
  - a. Valence bond theory of covalent bonding
  - b. Lewis structures of ionic and covalent compounds
  - c. Resonance structures for compounds that have multiple equivalent Lewis structures
  - d. Polarity and solubility of compounds
  - e. Molecular geometry and three dimensional shapes of molecules
  - f. Drug molecules interaction with neurons
9. Arson Investigation
  - a. The chemistry of fire and thermal equilibrium
  - b. Combustion reactions and other oxidation reduction reactions
  - c. Calorimetry in phase changes and chemical reactions
  - d. Refining of petroleum and other fuels as sources of energy
10. Chemistry of Explosions
  - a. Oxygen balance in explosive materials and high and low explosives
  - b. Gas properties relating to the kinetic-molecular theory
  - c. Gas behavior and the gas laws
  - d. Stoichiometry using the gas laws
  - e. Dalton's law of partial pressures and mixtures of gases