Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: CHEM107 **Year: 2024-2025**

Course Title: General Chemistry I **Credit Hours: 4**

I. Course Description: This is a thorough study of basic principles and concepts in chemistry. Topics include atoms, molecules, ions, chemical formulas, equations, stoichiometry, gases, electronic structure of atoms, periodic table, bonding, physical properties, phase changes, and thermochemistry. Laboratory experiments are hands-on, wet-labs performed in a traditional chemistry lab under the supervision of a chemistry professor. Substantial outside preparation for the laboratories is required. CHEM107 fulfills the SUNY General Education Natural Sciences requirement. Prerequisites: Any college MATH level course and college prep chemistry or CHEM101; ENGL100 (or prior completion of ESL 103) if required by placement testing. 4 Cr. (3 Lec. 2 Lab.) Fall semesters.

II. Additional Course Information:

1.	This course can satisfy program requirements for Liberal Arts and Sciences - Math & Science, Biology A.S., Environmental Studies A. S. and an unrestricted elective in any program.
2.	CHEM107 is a prerequisite for the CHEM108 course and CHEM205.
3.	This course may incur an additional laboratory fee.
4.	The SUNY supported course management system (BrightSpace) is used to post the course syllabus, outline, course materials and related links. Including on-line quizzes, lab manual and discussion materials. Use of other on-line course management systems are encouraged.

III. Student Learning Outcomes

Upon successful completion of this course, students will be able to:

Demonstrate scientific reasoning applied to the natural world, including:

- an understanding of the methods that scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling as assessed by lab reports and oral/poster presentations,
- application of scientific data, concepts, and models in one of the natural or physical sciences as assessed by projects or practicums,
- illustrate proficiency in technical skills enabling them to function in a chemistry laboratory as assessed by lab notebook documentation.

IV. Tompkins Cortland Institutional Learning Outcomes; Program Learning Outcomes; SUNY General Education Competencies and Knowledge and Skills Areas

Tompkins Cortland ILOs

Complete this section for “service” courses only (e.g., courses that are required of all students; courses that are not program specific but satisfy liberal arts requirements; or commonly used in multiple academic programs to meet non-program-specific requirements). Check only Institutional Learning Outcomes (ILOs) that are meaningfully developed and assessed in this course. For each ILO chosen, include the SLO to which it aligns.

Students will:

☐ Communicate effectively, in oral and written forms, taking into consideration audience and purpose.

☒ Apply principles and methods of scientific inquiry and quantitative reasoning appropriate to their discipline.

1. Describe the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling as assessed by lab reports, oral presentation, poster presentations. 2. Apply scientific data, concepts, and models in one of the natural sciences as assessed by projects, practicums and/or solving case studies.

2. Apply scientific data, concepts, and models in one of the natural sciences as assessed by projects, practicums and/or solving case studies.

☐ Use information, critical thinking, and the creative process to solve problems and reach conclusions.

☐ Use technology appropriate to their discipline.

☐ Describe the ways in which social, economic, or environmental sustainability depends on their own and the collective contributions of a diversity of ideas and people.

Program Learning Outcomes

Complete this section for program-specific courses (e.g., those that share the same discipline code as the academic program or satisfy requirements in related programs). List the academic program(s) here and note which Student Learning Outcomes align to specific Programmatic Learning Outcomes. Please see the MCS Instructions for more details.

Specify the Academic Program: Biotechnology Certificate

- PLO: illustrate a proficiency in technical skills enabling them to function in a chemistry laboratory as assessed by lab notebook documentation.

SUNY General Education Competencies

If this course assesses a SUNY GEN ED Competency, check all that apply and indicate which course outcome(s) address each checked item:

☐ CRITICAL THINKING & REASONING- Students will:

- identify, analyze, and evaluate ideas, data, and arguments as they occur in their own or others' work; acknowledge limitations such as perspective and bias.

☐ INFORMATION LITERACY - Students will:

a. locate information effectively using tools appropriate to their need and discipline; evaluate information with an awareness of authority, validity, and bias; and demonstrate an understanding of the ethical dimensions of information use, creation, and dissemination.

Course SLO(s):

☒ SUNY GENERAL EDUCATION KNOWLEDGE AND SKILLS AREA(s): Natural Sciences
For courses that are approved to meet one (or more) of the ten SUNY General Education Knowledge and Skills Areas, indicate which area the course fulfills, and which outcome(s) are aligned with the SUNY outcomes for that area:

Course SLO(s): Students will demonstrate scientific reasoning applied to the natural world, including

- an understanding of the methods that scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of

evidence, and employment of data analysis or mathematical modeling as assessed by lab reports and oral/poster presentations,
- application of scientific data, concepts, and models in one of the natural or physical sciences as assessed by projects or practicums,

☐ This course does not address any of the above Tompkins Cortland ILOs, PLOs, or SUNY General Education Competencies or Knowledge and Skills Areas.

V. Essential Topics/Themes

1.	**Matter and Measurement** - Upon completion of this topic, a student should be able to: 1. Describe the three states of matter in terms of molecular or ionic structure and physical properties; 2. Know the common metric units used in chemistry; 3. Convert units; 4. Use scientific notation and significant figures.
2.	**Atoms, Molecules, Ions** - Upon completion of this topic, a student should be able to: 1. Distinguish among atoms, molecules, and ions; 2. List and describe the components of an atom; 3. Use and explain the periodic table; 4. Name and write chemical formulas of simple inorganic molecules.
3.	**Stoichiometry** - Upon completion of this topic, a student should be able to: 1. State the two fundamental definitions of the mole; 2. Understand mass relations in chemical formulas and chemical reactions; 3. Perform stoichiometric calculations involving moles and mass.
4.	**Gases** - Upon completion of this topic, a student should be able to: 1. Understand the kinetic theory of gas; 2. Perform calculations involving the gas laws; 3. Define: partial pressure, temperature, ideal gas, standard temperature, and standard pressure; 4. Explain how and why real gases differ from ideal behavior.
5.	**Electronic Structure** - Upon completion of this topic, a student should be able to: 1. Define: light, photon, electronic energy levels, orbitals, electron spin, quantum numbers; 2. Write the complete electron configuration for any atom; 3. Write the orbital diagram for any atom; 4. Explain the relationship of the quantum mechanical description of the atom to the arrangement of the periodic table.
6.	**Covalent Bonding and Molecular Structure** - Upon completion of this topic, a student should be able to: 1. Write Lewis structures for simple inorganic molecules; 2. Determine the polarity and orbital hybridization for simple inorganic molecules; 3. Identify the molecular shape (linear, bent, pyramidal, triangular, planar, or tetrahedral) of simple molecules; 4. Understand orbital hybridization.
7.	**Liquids and Solids** - Upon completion of this topic, a student should be able to: 1. Understand liquid-vapor equilibrium; 2. Draw a phase diagram for a substance; 3. Identify and explain the type of intermolecular force in a substance; 4. Identify the type of structure (ionic, molecular, network covalent, metallic, amorphous) of a solid.
8.	**Thermochemistry** – Upon completion of this topic, a student should be able to: 1. Relate heat flow to specific heat, mass and temperature change; 2. Relate enthalpy change to forward and reverse reactions; and 3. Calculate heat for a reaction from colorimetric data.
9.	**Scientific Method and Laboratory Experience**- Upon completion of this topic, a student should be able to: 1. Recognize, use, and distinguish among simple chemical laboratory equipment such as: beaker, Erlenmeyer flask, graduated cylinder, burette, barometer, thermometer, centigram, balance, electronic milligram balance, and Bunsen burner; 2. Perform simple chemical laboratory experiments; 3. Follow proper safety procedures and techniques.

VI. Methods of Assessment/Evaluation

Method	**% Course Grade**
Assessment/Evaluation	
1. 3-4 Major exams each on several chapters	**35-45%**
2. Final exam (cumulative)	**20-30%**

3. Lab reports, notebook prep, and/or lab practicums (Includes assessment material for SLO 1, 2 and 3)	**25-35%**
4. Homework assignments, journal reports and quizzes	**10-20%**
5. Term and special projects	**5-10%**

VII. Texts – ☐ Required ☒ Recommended ☒ Used for more than one course (list courses)

High school instructors may consult with staff in the CollegeNow office for additional information and guidance.

	OER
1. *Chemistry: Principles and Reactions*, William L. Masterton, Cecile N. Hurley, and Edward J. Neth, 8th edition, © 2016 Brooks/Cole Publishing (required)- used for CHEM 107,108	☐
2. Lab Manual, revised by Jiang Zhao, to accompany main textbook (required)	☐
3. Student Solutions Manual, Maria Cecilia D. De Mesa and Thomas D. McGrath, 8th edition, © Brooks/Cole Publishing (recommended)- CHEM 107,108	☐

Editions listed are current as of date of syllabus. More recent editions may be used.

VIII. Bibliography of Supplemental Materials

1. *Wolfram Alpha* app- for acquiring reliable chemical data and properties for lab notebook prep
2. *ACS (American Chemical Society) www.acs.org*
3. *Journal of Chemical Education* (past and present journal issues)

Editions listed are current as of date of syllabus. More recent editions may be used.

IX. Other Learning Resources

Audiovisual: video (YuJa) on lab notebook documentation, video for creating a Python program for term project
Electronic: Visual Studio Code software from Microsoft for running Python code
Other: access to TC3 library databases for finding journal articles e.g. *Scientific American* (past and present journal issues)
***Credit/Contact Hour Relationship**: The State University of New York, like most of American higher education, has adopted a variant of the traditional "Carnegie Unit" as a measure of academic credit. This unit is known in the State University by the familiar term, "semester credit hour," and is the primary academic measure by which progress toward a degree is gauged. In the interest of accurate academic measurement and cross campus comparability, the following definitions and practices apply in controlling the relationship between contact and credit hours. A semester credit hour is normally granted for satisfactory completion of one 50-minute session of classroom instruction per week for a semester of not less than fifteen weeks. This basic measure may be adjusted proportionately to reflect modified academic calendars and formats of study. Semester credit hours are granted for various types of instruction.(SUNY Memorandum to Presidents, Vol. 76 #8, 1976)*

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for academic adjustments. All course materials are available in alternate formats upon request.*

Academic Integrity: *Every student at Tompkins Cortland Community College is expected to act in an academically honest fashion in all aspects of their academic work: in writing papers and reports, in taking examinations, in performing laboratory experiments and reporting the results, in clinical and cooperative learning experiences, and in attending to paperwork such as registration forms.*
Any written work submitted by a student must be their own. If the student uses the words or ideas of someone else, they must cite the source by such means as a footnote. Our guiding principle is that any honest evaluation of a student's performance must be based on that student's work. Any action taken by a student that would result in misrepresentation of someone else's work or actions as the student's own — such as cheating on a test, submitting for credit a paper written by another person, or forging an advisor's signature — is intellectually dishonest and deserving of censure.
Several degree programs offer student learning opportunities (such as internships, field work, and clinical experiences) outside the standard classroom setting. As part of the learning process, students must understand and engage in conduct that adheres to principles guiding employment within the professional workplace. These behaviors include, but are not limited to, academic integrity, accountability, reliability, respect, use of appropriate language and dress, civility, professional ethics, honesty, and trustworthiness. Disciplinary action may be initiated for inappropriate conduct occurring while participating in any course-related project or event.