### CHEM 3A Course Outline as of Fall 2022

# **CATALOG INFORMATION**

Dept and Nbr: CHEM 3A Title: GENERAL CHEMISTRY 1:LEC Full Title: General Chemistry Part 1: Lecture Last Reviewed: 5/13/2019

Units		<b>Course Hours per Week</b>		Nbr of Weeks	<b>Course Hours Total</b>	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	6	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00

Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

### **Catalog Description:**

General principles of chemistry, including atomic theory, bonding, stoichiometry, kinetic molecular theory of gases, properties of mixtures, the periodic table, and thermochemistry. Lecture portion of the first semester of a one-year program of general chemistry. (Students who have completed one year of high school chemistry should consider petitioning to enroll)

### **Prerequisites/Corequisites:**

Course Completion or Concurrent Enrollment in CHEM 3AL; AND Course Completion of CHEM 42; AND Course Completion of MATH 154 or MATH 155 or MATH 156 or higher (MATH); OR AB705 placement into <a href='https://assessment.santarosa.edu/understanding-your-math-placement' class='NormalSiteLink' target='\_New'>Math Tier 3 or higher.</a>

### **Recommended Preparation:**

Course Completion of ENGL 1A or equivalent

### **Limits on Enrollment:**

#### **Schedule of Classes Information:**

Description: General principles of chemistry, including atomic theory, bonding, stoichiometry, kinetic molecular theory of gases, properties of mixtures, the periodic table, and

thermochemistry. Lecture portion of the first semester of a one-year program of general chemistry. (Students who have completed one year of high school chemistry should consider petitioning to enroll) (Grade Only) Prerequisites/Corequisites: Course Completion or Concurrent Enrollment in CHEM 3AL; AND Course Completion of CHEM 42; AND Course Completion of MATH 154 or MATH 155 or MATH 156 or higher (MATH); OR AB705 placement into <a href='https://assessment.santarosa.edu/understanding-your-math-placement' class='NormalSiteLink' target='\_New'>Math Tier 3 or higher.</a> Recommended: Course Completion of ENGL 1A or equivalent Limits on Enrollment: Transfer Credit: CSU;UC. Repeatability: Two Repeats if Grade was D, F, NC, or NP

# **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

AS Degree:	Area C	Natural Science	es	Effective: Fall 2020	Inactive:
CSU GE:	<b>Transfer Area</b> B1			Effective: Fall 2020	Inactive:
IGETC:	<b>Transfer Area</b> 5A	Physical Science	ces	Effective: Fall 2020	Inactive:
CSU Transfer	:Transferable	Effective:	Fall 2020	Inactive:	
UC Transfer:	Transferable	Effective:	Fall 2020	Inactive:	

#### CID:

CID Descriptor:CHEM 110	General Chemistry for Science Majors I, with Lab
SRJC Equivalent Course(s):	CHEM1A OR CHEM4A OR CHEM3A AND CHEM3AL
CID Descriptor: CHEM 120S	General Chemistry for Science Majors Sequence A
SRJC Equivalent Course(s):	CHEM1A AND CHEM1B OR CHEM4A AND CHEM4B OR
-	CHEM3A AND CHEM3AL AND CHEM3B

## **Certificate/Major Applicable:**

Both Certificate and Major Applicable

# **COURSE CONTENT**

### **Student Learning Outcomes:**

At the conclusion of this course, the student should be able to:

- 1. Describe matter, its transformations and corresponding energy changes according to prevailing chemical theories.
- 2. Interpret and solve problems in a chemical context using quantitative reasoning.

## **Objectives:**

At the conclusion of this course, the student should be able to:

- 1. Use dimensional analysis and stoichiometry to solve quantitative chemical problems.
- 2. Apply atomic theory in describing matter, including chemical nomenclature and physical and chemical processes.
- 3. Summarize the quantum mechanical structure of the hydrogen atom in light of its emission spectrum, and apply it to many-electron systems.

- 4. Calculate energy changes in calorimetry and chemical reactions.
- 5. Use the periodic table of elements to recognize trends and patterns, and to perform calculations.
- 6. Describe the bonding and shapes of simple compounds with a range of models.
- 7. Apply kinetic-molecular theory to the behavior of ideal and real gases.
- 8. Relate intermolecular forces to the physical properties of matter.
- 9. Calculate the effects of solute concentration on the physical properties of solutions.
- 10. Apply chemical principles to real world situations.

## **Topics and Scope:**

- I. Basic Tools and Problem Solving
  - A. Metric system and units
  - B. Dimensional analysis and conversions
  - C. Significant figures
- II. Stoichiometry
  - A. Amount of substance and molar mass
  - B. Mass calculations
  - C. Limiting reactants and yields
  - D. Concentration and solution stoichiometry
  - E. Gas stoichiometry
  - F. Energy calculations
- III. Atomic Theory
  - A. States of matter
  - B. Nomenclature of simple compounds
  - C. Chemical composition
    - 1. Mass fraction
    - 2. Empirical formulas
    - 3. Molecular formulas
  - D. Chemical reactions
    - 1. Balancing
    - 2. Precipitation
    - 3. Acid-base
    - 4. Oxidation-reduction
- IV. Structure of the Atom
  - A. Light and the electromagnetic spectrum
  - B. Emission spectra
  - C. Bohr model of hydrogen
  - D. Quantum mechanical model of the atom
  - E. Quantum numbers
  - F. Writing electron configurations
- V. Thermochemistry
  - A. Calorimetry
  - B. Pressure-Volume (PV) work
  - C. Energy vs. enthalpy
  - D. Hess's law
  - E. Enthalpies of formation
  - F. Reaction enthalpies

G. Bond energies and reaction enthalpies

VI. Periodic Trends

- A. Atomic size
- B. Ionization energy
- C. Electronegativity
- D. Ionic radius

# VII. Bonding and Molecular Structure

- A. Ionic bonding
- B. Born-Haber cycle
- C. Lewis structures
- D. Valence Shell Electron Pair Repulsion (VSEPR) Theory
- E. Covalent bond order, polarity, energy and length
- F. Hybridization of atomic orbitals
- G. Valence Bond (VB) theory
- H. Molecular Orbital (MO) theory
- VIII. Kinetic Molecular Theory of Gases
  - A. Molecular scale understanding of gas pressure and temperature
  - B. Development and applications of the ideal gas law
  - C. Dalton's law of partial pressures
  - D. Graham's law of effusion and diffusion
  - E. Approximating real gases with the van Der Waals equation

# IX. Intermolecular Forces (IMF)

- A. Molecular polarity
- B. Types of intermolecular forces
- C. Physical properties and IMF
- D. Phases and phase diagrams
- X. Liquids and Solids
  - A. Properties of the liquid state
  - B. Uniqueness of water
  - C. Structure, properties and bonding in the solid state
  - D. Structure of crystalline solids

# Assignment:

- 1. Specific reading and study assignments from the textbook (20-30 pages per week)
- 2. Completion of recommended homework problems (0-30 per week)
- 3. Midterm exams (3-5 per semester), quizzes (0-4 per semester), final exam
- 4. Research paper

# Methods of Evaluation/Basis of Grade:

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because this course includes essay exams that fulfil the writing component of the course.

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None

**Exams:** All forms of formal testing, other than skill performance exams.

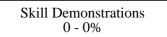
Midterm exams, quizzes, final exam

**Other:** Includes any assessment tools that do not logically fit into the above categories.

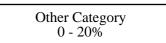
Research project



Problem solving 0 - 40%



Exams 40 - 100%



### **Representative Textbooks and Materials:**

Chemistry: The Molecular Nature of Matter and Change. 8th ed. Silberberg, Martin and Amateis, Patricia. McGraw-Hill. 2018

Chemistry. 13th ed. Chang, Raymond and Overby, Jason. McGraw-Hil. 2019

General Chemistry. 4th ed. McQuarrie, Donald and Rock, Peter and Gallogly, Ethan. University Science Books. 2010 (classic)

Chemistry: The Science in Context. 5th ed. Gilbert, Thomas and Kirss, Rein and Foster, Natalie. W. W. Norton. 2017

Chemistry: A Molecular Approach. 4th ed. Tro, Nivaldo. Prentice Hall. 2017