

**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        | Course Hours per Week  | Nbr of Weeks | Course Hours Total      |
|--------------|------------------------|--------------|-------------------------|
| 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 <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)

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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:**

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

|                            |           |                                                                         |  |  |
|----------------------------|-----------|-------------------------------------------------------------------------|--|--|
| <b>CID:</b>                |           |                                                                         |  |  |
| 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:**

Students will 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.

Writing  
0 - 0%

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

Homework problems

Problem solving  
0 - 40%

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

None

Skill Demonstrations  
0 - 0%

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

Midterm exams, quizzes, final exam

Exams  
40 - 100%

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

Research project

Other Category  
0 - 20%

### 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-Hill. 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