# CHEM R110: ELEMENTARY CHEMISTRY

**Originator**
atoypalmer

**College**
Oxnard College

**Discipline (CB01A)**
CHEM - Chemistry

**Course Number (CB01B)**
R110

**Course Title (CB02)**
Elementary Chemistry

**Banner/Short Title**
Elementary Chemistry

**Credit Type**
Credit

**Start Term**
Fall 2021

**Catalog Course Description**
This is an introductory course in chemistry stressing the basic principles of atomic and molecular structure, compound formation and chemical reactivity, the periodic table and states of matter. Quantitative techniques involved in elementary chemical calculations will be emphasized. In addition, the course serves as an introduction to lab techniques with experiments illustrating principles covered in lecture.

**Taxonomy of Programs (TOP) Code (CB03)**
1905.00 - Chemistry, General

**Course Credit Status (CB04)**
D (Credit - Degree Applicable)

**Course Transfer Status (CB05) (select one only)**
A (Transferable to both UC and CSU)

**Course Basic Skills Status (CB08)**
N - The Course is Not a Basic Skills Course

**SAM Priority Code (CB09)**
E - Non-Occupational

**Course Cooperative Work Experience Education Status (CB10)**
N - Is Not Part of a Cooperative Work Experience Education Program

**Course Classification Status (CB11)**
Y - Credit Course

**Educational Assistance Class Instruction (Approved Special Class) (CB13)**
N - The Course is Not an Approved Special Class

**Course Prior to Transfer Level (CB21)**
Y - Not Applicable

**Course Noncredit Category (CB22)**
Y - Credit Course

**Funding Agency Category (CB23)**
Y - Not Applicable (Funding Not Used)

**Course Program Status (CB24)**
1 - Program Applicable

**General Education Status (CB25)**
Y - Not Applicable

**Support Course Status (CB26)**
N - Course is not a support course

**Field trips**
May be required

**Grading method**
Letter Graded

**Does this course require an instructional materials fee?**
No

**Repeatable for Credit**
No

**Is this course part of a family?**
No

## Units and Hours

**Carnegie Unit Override**
No

## In-Class

**Lecture**
**Minimum Contact/In-Class Lecture Hours**
70
**Maximum Contact/In-Class Lecture Hours**
70

**Activity**

**Laboratory**
**Minimum Contact/In-Class Laboratory Hours**
52.5
**Maximum Contact/In-Class Laboratory Hours**
52.5

## Total in-Class

**Total in-Class**
**Total Minimum Contact/In-Class Hours**
122.5
**Total Maximum Contact/In-Class Hours**
122.5

## Outside-of-Class

**Internship/Cooperative Work Experience**

**Paid**

**Unpaid**

## Total Outside-of-Class

**Total Outside-of-Class**
**Minimum Outside-of-Class Hours**
140
**Maximum Outside-of-Class Hours**
140

## Total Student Learning

**Total Student Learning**
**Total Minimum Student Learning Hours**
262.5
**Total Maximum Student Learning Hours**
262.5

**Minimum Units (CB07)**
5
**Maximum Units (CB06)**
5

**Prerequisites**
MATH R005 or MATH R015

## Entrance Skills

**Entrance Skills**
Graph and interpret collected data, write and solve algebraic equations, Wand write and solve rational expressions

**Prerequisite Course Objectives**
MATH R005-Simplify algebraic expressions
MATH R005-Solve linear equations.
MATH R005-Graph linear equations by plotting points and using intercepts.
MATH R005-Simplify rational expressions and solve rational equations.
MATH R005-Simplify expressions involving positive, negative, and rational exponents.
MATH R005-Perform mathematical operations on radical expressions and solve radical equations.
MATH R005-Graph and evaluate elementary functions.
MATH R005-Solve elementary exponential and logarithmic equations and related applications.

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**Entrance Skills**
Graph and interpret collected data, write and solve algebraic equations, Wand write and solve rational expressions

**Prerequisite Course Objectives**
MATH R015-Evaluate and simplify algebraic expressions.
MATH R015-Solve linear equations.
MATH R015-Simplify expressions with positive and negative exponents.
MATH R015-Convert decimals to scientific notation and vice versa.
MATH R015-Add, subtract, multiply, divide and simplify rational expressions.
MATH R015-Solve rational equations.
MATH R015-Graph linear functions and write using function notation.
MATH R015-Simplify radical expressions including those with rational exponents.
MATH R015-Solve radical equations and applications.
MATH R015-Solve elementary exponential and logarithmic equations.

## Requisite Justification

**Requisite Type**
Prerequisite

**Requisite**
MATH R005

**Requisite Description**
Course not in a sequence

**Level of Scrutiny/Justification**
Content review

**Requisite Type**
Prerequisite

**Requisite**
MATH R015

**Requisite Description**
Course not in a sequence

**Level of Scrutiny/Justification**
Content review

**Student Learning Outcomes (CSLOs)**

| | Upon satisfactory completion of the course, students will be able to: |
|---|---|
| 1 | Memorize metric conversion factors and carry out conversions using the technique of dimensional analysis. |
| 2 | Perform stoichiometric calculations using the mole concept and molar mass; determine weight percent composition, empirical formula, and molecular formula; carry out determination of theoretical yields, limiting reactants and percent yields based on balanced chemical equations. |

**Course Objectives**

| | Upon satisfactory completion of the course, students will be able to: |
|---|---|
| 1 | Analyze the fundamental features of chemistry including the measurement and mathematical conversions of physical properties such as mass, volume, density, pressure, temperature, solutions, concentrations, and dilutions. |
| 2 | Perform conversions using the technique of dimensional analysis and memorized metric conversion factors. |
| 3 | Give the names and symbols of the common elements. |
| 4 | Name or give the formulas of simple inorganic compounds. |
| 5 | Identify and give general physical properties of the three states of matter and then describe the phase-changes between the three states. |
| 6 | Differentiate clearly between chemical and physical changes, and among elements, compounds and mixtures. |
| 7 | Write and evaluate chemical reactions and balance chemical equations. |
| 8 | Perform stoichiometric calculations using the mole concept and molar mass to determine weight percent composition, empirical formula, molecular formula, theoretical yield, percent yield and limiting reactant. |
| 9 | Describe atomic structure in terms of protons, neutrons, and electrons using the Bohr model. |
| 10 | Relate electron configuration to the periodic table, and use the periodic table to predict or explain variations in atomic size, ionization energy, electronegativity, and metallic or non-metallic character. |
| 11 | Describe covalent and ionic bonding in simple terms. Predict molecular shapes and polarities based on VSEPR (Valence Shell Electron Pair Repulsion) Theory. |
| 12 | Describe and explain the properties of gases in terms of KMT (Kinetic Molecular Theory). Calculate gas properties from the gas laws. |

| | |
|---|---|
| 13 | Describe the properties of water and other liquids. |
| 14 | Categorize the properties of solutions and describe the solution process on a molecular level. |
| 15 | Give common concentration units and use them to perform calculations involving solutions. |
| 16 | Describe properties of acids and bases, calculate pH, and compare and contrast the behavior associated with acids and bases. |

## Course Content

**Lecture/Course Content**

1. Basics
   a. Math review, metric system, dimensional analysis, significant figures, scientific notation, and measurement
2. Classification and Properties of Matter
   a. Substances, mixtures, compounds, elements, atomic symbols
   b. Physical and chemical properties and changes
   c. Energy and states of matter
3. Inorganic Nomenclature
   a. Names of ionic compounds
   b. Names of covalent compounds
   c. Names of acids
4. Chemical Formula
   a. Formula writing, charges of ions
   b. Formula weight, percent composition
   c. Empirical and molecular formula
5. Equations and Stoichiometry
   a. Evaluate chemical reactions
   b. Write and balance equations
   c. Mole concept
   d. Combining weight, yield, limiting reactant, percent yield
6. Atomic Theory and the Periodic Table
   a. Bohr theory and the modern atom
   b. Electron configuration and periodic properties
7. Chemical Bonding
   a. Ionic and covalent bonding, valence electrons
   b. Lewis dots, multiple bonding, resonance
   c. Molecular geometry, VSEPR, bond and molecular polarity
8. Gaseous State of Matter
   a. Gas laws: ideal gas equations and subsets
   b. Kinetic Molecular Theory
9. Water and Properties of Liquids
   a. Intermolecular forces of attraction, physical properties, phase changes
10. Solutions
    a. Components of solutions, the solution process, solution concentrations, and stoichiometry
    b. Colligative properties, ionization, acids, bases, salts
11. Miscellaneous
    a. As time allows, brief discussion of net ionic equations, equilibrium, redox, nuclear, organic, and biochemistry

**Laboratory or Activity Content**

1. Reading Reagent Bottle Labels and Reference Books
   a. Lab safety
   b. Merck Index
   c. Chemical Rubber Company Handbook of Chemistry and Physics
2. Introduction to Lab Manipulations
   a. Use of the meter stick, test tubes, graduated cylinders, Erlenmeyer flasks, evaporating dish
   b. Operations of the Bunsen burner and estimation of burner temperature
   c. Use of the balance for measuring mass
3. Understanding Density

a. Calculation of density of water using balance and graduated cylinder
b. Calculation of density of unknown liquid using a pipet, crucible and balance
c. Calculation of density of metal sample using graduated cylinder and balance

4. Preparation and Properties of Hydrogen Gas
   a. Preparation of hydrogen gas by several reactions and testing for presence of gas
   b. Construction of a hydrogen generator to collect bottles of hydrogen gas
   c. Properties of hydrogen gas are tested using samples of hydrogen gas collected
5. Preparation and Properties of Oxygen Gas
   a. Construction of an oxygen generator to collect bottles of oxygen gas
   b. Properties of oxygen gas are tested using samples of oxygen gas collected
6. Nomenclature and Formula Writing
   a. Practice on naming ionic compounds, binary covalent compounds, acids and bases
   b. Practice on writing formulas for compounds stated in #1 from names
7. Determining the Formula of a Hydrated Salt
   a. Obtaining mass measurements of an unknown substance before and after removal of water
   b. Use the mass measurements to determine the formula of the unknown salt
8. Investigating Single Replacement Reactions
   a. Development of the activity series from reactions of metals with metal salts
   b. Incorporation of hydrogen into the activity series from reactions of metals with acids
9. Investigating Double Replacement Reactions
   a. Mixing of various solutions containing ionic compounds and acids in order to observe reactions
   b. Writing of double replacement reactions on the basisof observations in #1 above
10. Discovery of Periodic Properties
    a. Observation of some reactions of four groups of elements on the periodic table
    b. Research into physical preoperties of four groups of elements on the period table
11. Building Molecular Models
    a. Drawing Lewis dot structures to represent molecules
    b. Building of molecular models using ball stick model kits
    c. Prediction of bond angles, molecular shapes and molecular polarity from model
12. Observation of Charles' Law
    a. Verification of Charles' law using a sample of air
    b. Calculation of the final volume of the air sample after heated air sample is cooled at constant pressure
13. Investigating Properties of Solution
    a. Observation of solubility of various substances in water and other solvents
    b. Preparation and observation of a saturated solution
    c. Preparation and observation of a colloidal suspension
    d. Observation of factors that affect the rate at which a solute dissolves in a solvent
14. Volumetric Analysis - Acid Base Titrations
    a. Preparation of a solution of sodium hydroxide
    b. Becoming familiar with the method of titration using a buret, and acid and a base and an indicator
    c. Standardization of the base solution and use of the base solution in a titration to calculate the molarity of an acid solution
15. Red Cabbage Extract as an Indicator
    a. Preparation of red cabbage extract
    b. Use of red cabbage extract to detect the pH of various solutions

## Methods of Evaluation

**Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):**

Problem solving exercises
Written expression

**Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):**

Computational homework
Essay exams
Laboratory activities
Laboratory reports
Objective exams
Oral presentations
Projects
Problem-Solving Assignments

Problem-solving exams
Quizzes
Reports/papers

## Instructional Methodology

**Specify the methods of instruction that may be employed in this course**

Audio-visual presentations
Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Distance Education
Demonstrations
Field trips
Group discussions
Internet research
Laboratory activities
Lecture

**Describe specific examples of the methods the instructor will use:**

1. The instructor will use audio-visual instruction including PowerPoint presentations, videos and chalkboard/white board lectures.
2. The instructor will include group discussions and other class activities to allow students to participate in active learning. The instructor will be available for questions and clarification of chemistry concepts.
3. The instructor will assign laboratory activities and give demonstrations that teach laboratory technique and apply concepts from the lectures. Experiments are typically in-person activities. However, use of audio-visual techniques and computer-aided simulations and presentations will also illustrate and underscore the important concepts from lecture.
4. The instructor will use PowerPoint presentations and chalkboard discussions to introduce how to use measurements in a calculation and address error of measurement. The assigned associated laboratory activity requires students to measure items in the laboratory, apply the appropriate metric units and perform calculations based on the concepts they learned from lecture.

## Representative Course Assignments

**Writing Assignments**

1. Students answer the questions at the end of each chapter related to the electron configuration to the periodic table, and explain the metallic or non-metallic characters based on valence electrons.
2. Students write essays to describe the properties of water and solution.
3. Students enter the data collected in the lab period, and give the explanation of the activities of alkali metals, halogens, etc.

**Critical Thinking Assignments**

1. Students are required to describe and explain why an chemical reaction has occurred. For instance, students must carry out a chemical reaction, describe what happens as a result of the reaction, then write the balanced chemical equation that describes their observation.
2. Another assignment is to propose a hypothesis when presented an observation. The student then needs to describe how one might devise an experiment in order to test that hypothesis.

**Reading Assignments**

1. Textbook and Lab Manual
2. Professional Journals; such as Journal of Chemical and Engineering News, published by American Chemical Society.
3. Internet; such as www.acs.org (http://www.acs.org), www.chemweb.com, http://ocw.mit.edu/OcwWeb/Chemistry/, www.anytimetutor.com (http://www.anytimetutor.com)

**Skills Demonstrations**

1. Students must demonstrate that they can follow safety procedures in the chemical laboratory.
2. Students will be able to correctly read measurements from calibrated chemical glassware when handling liquids.
3. Students can safely use the Bunsen burner.
4. Students will be able to use the data they obtain in lab to calculate their final results with the correct significant figure. They can then analyze the results to determine percent of error and describe systematic and non systematic sources that can account for this error.

**Other assignments (if applicable)**

1. Encourage students to form a study group and work together to solve the unit conversion problems.
2. Help students individually in instructor's office to advise the critical thinking related with periodic table.

## Outside Assignments

**Representative Outside Assignments**

Students will be required to

1. read the textbook, lab manual and other relevant material
2. complete weekly homework assignments
3. answer the questions at the end of each chapter (for example, relate the electron configuration to the periodic table, and explain the metallic or non-metallic characters based on valence electrons)
4. write an essay to describe the properties of water and solution
5. describe and explain why some chemical reactions have occurred, then write the balanced chemical equations
6. propose a hypothesis when presented an observation then devise an experiment in order to test that hypothesis
7. form a study group and work together to solve unit conversion problems

## Articulation

**C-ID Descriptor Number**

CHEM 101

**Status**

Approved

**Comparable Courses within the VCCCD**

CHEM M12 - Introductory Chemistry I

## District General Education

## A. Natural Sciences

**A2. Physical Science**

Approved

## B. Social and Behavioral Sciences

## C. Humanities

## D. Language and Rationality

## E. Health and Physical Education/Kinesiology

## F. Ethnic Studies/Gender Studies

**Course is CSU transferable**

Yes

## CSU GE-Breadth

## Area A: English Language Communication and Critical Thinking

## Area B: Scientific Inquiry and Quantitative Reasoning

**B1 Physical Science**

Approved

**B3 Laboratory Activity**
Approved

### Area C: Arts and Humanities

### Area D: Social Sciences

### Area E: Lifelong Learning and Self-Development

### Area F: Ethnic Studies

### CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

## UC TCA

**UC TCA**
Approved

## IGETC

### Area 1: English Communication

### Area 2A: Mathematical Concepts & Quantitative Reasoning

### Area 3: Arts and Humanities

### Area 4: Social and Behavioral Sciences

### Area 5: Physical and Biological Sciences

**Area 5A: Physical Science**
Approved

**Area 5C: Laboratory Science**
Approved

### Area 6: Languages Other than English (LOTE)

## Textbooks and Lab Manuals

**Resource Type**
Manual

**Description**
L. Crockett (2016). *Chemistry R110 Laboratory Packet* (Latest ). Oxnard College, Oxnard.

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**Resource Type**
Textbook

**Description**
Hein, M., Arena, S and Willard, C. (2016). *Foundations of College Chemistry* (15th). Wiley Publishers, Hoboken, NJ

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**Resource Type**
Other Instructional Materials

**Description**
Safety goggles.

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**Resource Type**
Other Instructional Materials

**Description**
Scientific calculator.

## Distance Education Addendum

## Definitions

**Distance Education Modalities**
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

## Faculty Certifications

**Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.**
Yes

**Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.**
Yes

## Regular Effective/Substantive Contact

**Hybrid (1%–50% online) Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Synchronous Dialog (e.g., online chat) | Instructors may choose to provide online chat room conference times. |
| Video Conferencing | Instructors may choose to provide online video conference times |
| Asynchronous Dialog (e.g., discussion board) | Regular discussions between students via discussion boards or other collaborative tools, such as Google Docs and CANVAS. |
| Other DE (e.g., recorded lectures) | Instructors may choose to record video lectures and presentations. They may also use preexisting video or other digital material. |

**Hybrid (51%–99% online) Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Synchronous Dialog (e.g., online chat) | Instructors may choose to provide online chat room conference times. |
| Video Conferencing | Instructors may choose to provide online video conference times |
| Asynchronous Dialog (e.g., discussion board) | Regular discussions between students via discussion boards or other collaborative tools, such as Google Docs and CANVAS. |
| Other DE (e.g., recorded lectures) | Instructors may choose to record video lectures and presentations. They may also use preexisting video or other digital material. |

**100% online Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Synchronous Dialog (e.g., online chat) | Instructors may choose to provide online chat room conference times. |
| Video Conferencing | Instructors may choose to provide online video conference times |

| | |
|---|---|
| Asynchronous Dialog (e.g., discussion board) | Regular discussions between students via discussion boards or other collaborative tools, such as Google Docs and CANVAS. |
| Other DE (e.g., recorded lectures) | Instructors may choose to record video lectures and presentations. They may also use preexisting video or other digital material. |

## Examinations

**Hybrid (1%–50% online) Modality**
Online
On campus

**Hybrid (51%–99% online) Modality**
Online
On campus

**Primary Minimum Qualification**
CHEMISTRY

## Review and Approval Dates

**Department Chair**
09/02/2020

**Dean**
09/02/2020

**Technical Review**
09/09/2020

**Curriculum Committee**
09/09/2020

**DTRW-I**
MM/DD/YYYY

**Curriculum Committee**
11/25/2020

**Board**
MM/DD/YYYY

**CCCCO**
MM/DD/YYYY

**Control Number**
CCC000226269

**DOE/accreditation approval date**
MM/DD/YYYY