Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108;
Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0;
Total Student Learning Hours: 192-216

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Chemistry 120 – Preparation for General Chemistry

3 hours lecture, 3 units
3 hours laboratory, 1 unit
Total Units: 4 units

Catalog Description
Elementary principles of chemistry approached from a problem-solving perspective necessary to succeed in CHEM 141. Intensive study in the areas of problem solving, stoichiometry, chemical nomenclature, basic atomic theory and bonding, solutions, acid-base chemistry, redox reactions and gas laws. The laboratory will be an introduction to quantitative techniques, descriptive chemistry, gas laws, error analysis, and data treatment.

Prerequisite
Appropriate placement or Intermediate Algebra

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Computing and simplifying using the basic operations on real numbers, polynomials, logarithms, variables with rational exponents, algebraic expressions involving radicals, and numerical expressions involving absolute value.
2) Factoring using the greatest common factor.
3) Solving linear equations with one or two variables, systems of linear equations in two variables, and quadratic equations with real solutions.
4) Solving word problems and applications by translating verbal expressions into algebraic expressions. Solving numerical and measurement problems and word problems involving linear equations.
5) Graphing and interpreting graphical data related to points, lines, slope-intercept form of the equation of a line; graphing relations.

Course Content
1) The Nature of Matter
2) Chemical Nomenclature
3) Chemical Reactions
4) Atomic Structure and Bonding
5) Chemical Calculations
6) The Behavior of Gases
7) Energy and States of Matter
8) Properties of Solutions
9) Introduction to Acid/Base Chemistry

Course Objectives
Students will be able to:
1) Classify a substance as a type of element, metal or nonmetal, or as a type of compound, ionic or covalent using the periodic table.

2) Write the correct chemical formula from a name and vice versa for simple compounds and molecules including covalent compounds, ionic compounds and hydrates.
3) Solve a variety of problems using dimensional analysis with the correct number of significant figures.
4) Perform a wide range of chemical calculations such as mass percentage, molar mass, empirical formula, stoichiometry, limiting reactant and solution concentration calculations.
5) Determine the electronic configuration of a given element from its position on the periodic table.
6) Write the Lewis Dot Structures and predict molecular geometry using the VSEPR Theory for polyatomic ions and simple molecules.
7) Classify bonds as nonpolar, polar or ionic. Using this information, determine polarity of molecules containing these bonds and make predictions about solubility properties, relative boiling point and relative vapor pressure.
8) Predict products and write balanced conventional equations for ordinary chemical processes.
9) Write conventional equations and net ionic equations for reactions in aqueous solutions.
10) Students will be able to explain how energy influences the motion and phase changes of matter through the study of temperature, heat transfer, and the states of matter.
11) Describe acid-base behavior both qualitatively and quantitatively using Arrhenius, Bronsted-Lowry and Lewis Theories along with the measurement of pH.
12) Solve quantitative problems involving at least two variables using the gas laws.
13) Identify and understand the relationship between concentration and temperature on the rate of a reaction.
14) Write equilibrium constant expressions for chemical reactions; apply Le Chatelier's Principle to a reaction at equilibrium to make predictions.
15) In the laboratory, observe and record qualitative phenomena and accurately measure quantitative properties of substances undergoing physical or chemical changes.
16) Analyze and evaluate both qualitative and quantitative observations acquired in the laboratory by applying the theoretical principles being studied in the course.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Exams consisting of question types as definitions, short essay, qualitative problems, and quantitative problems that measure students' ability to explain and apply the basic chemical concepts.
2) Laboratory activities that evaluate students' ability to observe the properties of a wide range of chemical substances, to apply competent observational skills, and to demonstrate proper collection and recording of data.
3) Written laboratory reports that measure students' ability to interpret and analyze both qualitative and quantitative data.
4) Problem sets including group problem sets that enable students to apply basic chemical principles and communicate those principles.

Special Materials Required of Student

Scientific calculator, laboratory notebook, safety glasses, combination lock

Minimum Instructional Facilities

1) Smart classroom with writing board, wall-sized periodic table, overhead projector/screen, demonstration table with sink and gas tap
2) Chemistry laboratory facility including lockers for lab equipment
3) Computer network connections for Internet access and performance of computer interfaced laboratory experiments including access to laptops with Vernier interfaces and miscellaneous probes

Method of Instruction

1) Lectures are designed to explain basic concepts. Ideas are introduced by presentation of data or generation of data through lecture demonstration. Analysis and explanations of data elicited from students by frequent and persistent questions. Applications to the real world are incorporated as much as possible.
2) Laboratories are correlated with lectures and are designed to allow students to make observations of chemical phenomena. Students work in pairs for most experiments. Lab reports and class discussion require students to explain their laboratory observations employing the concepts discussed in lectures.
3) Textbook and supplementary materials are required reading and are essential to successful solution of homework problems, performance of laboratory experiments, and performance on quizzes and exams.
4) Students are strongly encouraged to form study groups as well as to seek help through peer tutoring and instructor office hours.

Out-of-Class Assignments

Reading: Assigned chapters corresponding to the current unit; weekly study guides posted in Canvas; lecture notes and slides; lab manuals for upcoming experiments; vetted online materials supporting unit objectives; supplemental explanations for algebraic problem-solving, dimensional analysis, stoichiometry, gas laws, acid–base chemistry, and other topics needed for success in this course.

Writing / Problem Solving: Required pre-labs for every experiment, including purpose, materials, safety, procedures, and pre-lab questions; clear handwritten work for chemical calculations in lab reports (stoichiometry, gas laws, solutions, reactions, etc.); and organized written responses on worksheets. Students may also complete weekly Learning Activities for credit, choosing from options such as:

- writing and uploading handwritten lecture notes.
- posting thoughtful questions or answers on the Canvas discussion board.
- completing and submitting handwritten OWL problem work.
- attending tutoring or the instructor's help room and documenting participation.

These assignments support the development of strong problem-solving habits, clear written reasoning, and consistent practice with chemical concepts.

Other: Online homework assignments through learning platforms; participation in weekly Learning Activities such as discussion board posts, help room visits, tutoring sessions, or handwritten OWL work submissions; collaborative problem solving with peers in discussion forums; preparation for quizzes and exams through chapter assessments, practice problems, and unit study guides; review and annotation of instructor feedback to strengthen future work; construction of molecular models or diagrams when relevant; practice using scientific calculators for metric conversions, significant figures, and multi-step chemical calculations; maintenance of an organized lab notebook and completion of required pre-lab tasks; and consistent review of safety guidelines prior to laboratory sessions.

Texts and References

1) Required (representative examples):
   a. Cracolice and Peters, *Introductory Chemistry: An Active Learning Approach.* 8th edition. Cengage, 2026.
   b. LeBlanc, *Chemistry 120 Lab Manual*. Morton Publishing, 2019.
2) Supplemental: None

Exit Skills

Students having successfully completed this course exit with the following skills, competencies and/or knowledge:

1) Distinguish various classifications of matter including physical states, pure substances and mixtures, elements and compounds.
2) Understand and interpret the periodic table including periodic trends such as atom size and ionization energy.
3) Classify matter into different structural units of matter: atoms, molecules, ions, networks.
4) Differentiate between physical and chemical changes in matter; distinguish between physical and chemical properties of matter.
5) Understand the structure of atoms and the nature of subatomic particles; determine the number of each type of subatomic particle present within a given atom.
6) Write electron configurations for given atoms or ions.
7) Determine to which class–ionic or covalent–a compound belongs; write the formula for the compound and/or determine the name from the formula.
8) Make conversions between metric and English units; express numbers in scientific notation.
9) Understand and apply the mole concept.
10) Perform chemical calculations expressing answers to the correct number of significant figures.
11) Predict the products of chemical reactions and write balanced chemical equations for specific types of reactions.
12) Perform stoichiometry calculations; calculate percent yield and limiting reactant of a reaction.
13) Perform stoichiometry calculations involving aqueous solutions.
14) Write Lewis dot structures; predict and draw the geometry of molecules and polyatomic ions with as many as four regions of electron density around the central atom.
15) Understand and determine the magnitudes of angles in units of degrees.
16) Classify bonds into their various types: nonpolar, polar, ionic.
17) Predict physical properties of substances such as solubility and boiling point based on their polarity.
18) Identify common acids and bases; explain their properties including differences between strong and weak.
19) Calculate pH and hydrogen ion concentration of aqueous solutions.
20) Understand logarithms (base ten) and solve logarithmic equations.
21) Plot data graphically; analyze data using computer spreadsheet program.
22) From conventional equations of reactions involving metals, write the net ionic equations; identify half reactions and the species being oxidized and that being reduced.
23) Perform conversions with temperature and pressure units.
24) Solve word problems involving gases; identify variables and perform calculations involving gas laws, including the ideal gas law.

Student Learning Outcomes

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

1) Explain fundamental chemistry concepts such as the nature of matter, atomic structure, and chemical bonding, and balance chemical reactions.
2) Employ chemical calculations and unit conversions as problem-solving tools in a variety of topics, including chemical reactions (stoichiometry), solutions, acids and bases, equilibrium constants and gases.
3) Perform a variety of experimental techniques in the chemistry laboratory to collect, analyze and interpret data.