Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

Course Outline for CHEM 1A

GENERAL COLLEGE CHEMISTRY I

Effective: Spring 2016

I. CATALOG DESCRIPTION:
CHEM 1A — GENERAL COLLEGE CHEMISTRY I — 5.00 units

Introduction to atomic structure, bonding, stoichiometry, thermochemistry, gases, matter and energy, oxidation-reduction, chemical equations, liquids and solids, solutions, chemical energetics and equilibrium concepts. Laboratory includes both quantitative and qualitative experiments. Prerequisites: Mathematics 55 or 55B and Chemistry 31 (all courses completed with a grade of "C" or higher). The Chemistry 31 prerequisite can be fulfilled by demonstrating the appropriate skill level in the Chemistry Placement Process.

3.00 Units Lecture 2.00 Units Lab

Prerequisite
MATH 55 - Intermediate Algebra for STEM
with a minimum grade of C
or

MATH 55B - Intermediate Algebra for STEM B
with a minimum grade of C
and

CHEM 31 - Intro to College Chemistry
with a minimum grade of C

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Grading Methods:
Letter Grade

Discipline:

	MIN
Lecture Hours:	54.00
Lab Hours:	108.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:
Before entering the course a student should be able to:

A. MATH55
B. MATH55B
C. CHEM31

IV. MEASURABLE OBJECTIVES:
Upon completion of this course, the student should be able to:

A. Solve complex problems involving the concepts listed under course content;
B. Write short explanations describing various chemical phenomena studied;
C. Write balanced chemical equations including net ionic equations;
D. Write balanced chemical equations for oxidation-reduction reactions;
E. Describe the different models of the atom;
F. Use standard nomenclature and notation;
G. Calculate enthalpies of reaction using calorimetry, Hess's Law, heats of formation, and bond energies;
H. Describe hybridization, geometry and polarity for molecules and polyatomic ions;
I. Draw Lewis dot structures for molecules and polyatomic ions;
J. Describe bonding in compounds and ions;
K. Describe simple molecular orbitals of homonuclear systems;
L. Predict deviations from ideal behavior in real gases;
M. Describe the nature of solids, liquids, gases and phase changes;

N. Describe metallic bonding and semiconductors;
O. Describe network covalent bonding;
P. Define concentrations of solutions in terms of molarity, molality, normality, percent composition, and ppm;
Q. Describe colligative properties of solutions;
R. Solve solution stoichiometry problems;
S. Determine the extent of molecular reactions through the study of equilibrium;
T. Solve simple problems involving gas phase equilibria;
U. Apply Le Châtelier's principle to equilibria;
V. Utilize library and Internet resources in Chemistry;
W. Collect and analyze scientific data, using statistical and graphical methods;
X. Perform volumetric analyses;
Y. Use a barometer;
A@. Use a visible spectrophotometer;
AA. Use an atomic absorption spectrometer
AB. Perform gravimetric analysis
AC. Acquire and analyze data with a computer and appropriate software.

V. CONTENT:

A. Laboratory Safety
B. Review of matter and energy
C. Chemical equations, including net ionic equations, and chemical reactivity
D. Oxidation-reduction reactions, including balancing equations in acidic or alkaline solutions
E. Nomenclature
F. S.I. and metric units, including prefixes that range from at least T through f
G. Stoichiometry, including complex problems that apply stoichiometric principles in nonstandard ways
H. Atomic structure including an introduction to quantum mechanics and electron configurations for all the elements in the periodic table
I. Chemical bonding
    1. Lewis structures, including substances that violate the octet rule
    2. Molecular geometry, including 5 and 6 coordinate systems
    3. Hybridization
    4. Molecular Orbital Theory
J. Thermochemistry
    1. Calorimetry
    2. Heats of formation
    3. Hess's Law
    4. Bond energies
K. Gases
    1. Ideal
    2. Non-ideal
L. Liquids, solids, metallic bonding, and bonding in network covalent crystals
M. Solutions, solution stoichiometry, and colligative properties
N. Intermolecular forces of attraction
O. Molecular equilibria and general properties of equilibrium
P. Calorimetry experiment(s)
Q. Titration experiments
R. Gravimetric experiment(s)
S. Gas law experiments
T. Spectroscopy experiments such as visible and atomic absorption
U. Experiments utilizing computers equipped for data acquisition

VI. METHODS OF INSTRUCTION:

A. Lecture, informal with student questions encouraged
B. Models, periodic tables, videos, overhead transparencies
C. Safety and proper respect for chemicals and scientific apparatus are constantly stressed.
D. **Demonstration** -
E. Laboratory experimentation, including computer acquisition of data
F. Computer simulations

VII. TYPICAL ASSIGNMENTS:

A. Read Chapter 4 in Zumdahl and turn-in solutions and answers to questions # 5, 7, 10, 13, 15, 23, 26, 28, 30, 32, 36, 42, 44, 48, 52, 61, 66, 70ab, 74, 82, 84, 90, 91, 100, 109, 110, 111, 112, 113, 114, 117, 118, and 121
B. Complete a worksheet on molecular geometry.
C. Write correctly balanced oxidation/reduction equations for 20 reactions.
D. After completing the experiment "Spectroscopic Analysis of Crystal Violet", use spreadsheet software to generate two graphs:
    1. Absorbance vs. wavelength (to find optimum wavelength)
    2. Beer's Law plot (to determine concentration of product).

VIII. EVALUATION:

A. **Methods**

1. Other:
    a. Homework will be assigned, collected, and graded
    b. Quizzes may be used at the option of the instructor
    c. Written lab reports graded on criteria that may include the followingDescription of experimental procedures
        1. Completeness of data collected
        2. Quality of data collected
        3. Computational precision and accuracy
        4. Accuracy and precision of experimental laboratory results
        5. Proper use of symbolic notation
        6. Quality of analysis of scientific principles explored
        7. Quality of narrative explanations and reasoning
        8. Representation of data in tables or diagrams
    d. Midterm examinations or tests
    e. Final examination

B. **Frequency**

1. Homework: 10 to 20 assignments; 1 or 2 per chapter
2. Quizzes: options include daily, weekly, or biweekly

3. Written lab reports: 1 to 2 per week
4. Midterm examinations: 1 – 5 tests

IX. TYPICAL TEXTS:

1. Zumdahl, Steven, and Susan Zumdahl. *Chemistry*. 9 ed., Brooks Cole, 2014.
2. Tro, Nivaldo. *Chemistry A Molecular Approach*. 3 ed., Prentice Hall, 2014.
3. Silberberg, Martin, and Patricia Amateis. *Chemistry: The Molecular Nature of Matter and Change.* 7 ed., McGraw-Hill, 2015.
4. Las Positas College Faculty Past and Present. Chemistry 1A: General Chemistry Laboratory Manual. Las Positas College , 2015.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Safety goggles approved for chemistry laboratory
B. Scientific calculator
C. Student lab notebook