Course ID: CHEM R120
Curriculum Committee Approval Date: 11/14/2018
Catalog Start Date: Fall 2019

COURSE OUTLINE

OXNARD COLLEGE

I. Course Identification and Justification:

A. Proposed course id: CHEM R120
Banner title: General Chemistry I
Full title: General Chemistry I

Previous course id: CHEM R120
Banner title: General Chemistry I
Full title: General Chemistry I

B. Reason(s) course is offered:
General Chemistry is required in Oxnard College's A.A. and A.S. in Chemistry, AS-T in Biology, A. A. in Biology, and the A.A. and A.S. in Coastal Environmental Studies. At most universities, this course is required in Chemistry, Biology, Chemical Engineering, Pharmacy, and other science majors. It provides general education credit in the Natural Sciences in the Oxnard College General Education pattern, and in the Physical Sciences in both CSU GE-Breadth and IGETC. CHEM R120 is the prerequisite for General Chemistry II and Organic Chemistry.

C. Reason(s) for current outline revision:
changes to prerequisites ONLY due to AB705

D. C-ID:
1. C-ID Descriptor: CHEM 110; CHEM 120S (when taken w/ CHEM R122)
2. C-ID Status: Approved

E. Co-listed as:
Current: None
Previous:

II. Catalog Information:

A. Units:
Current: 5.00
Previous: 5.00

B. Course Hours:
1. In-Class Contact Hours:
Lecture: 52.5 Activity: 0 Lab: 105
2. Total In-Class Contact Hours: 157.5
3. Total Outside-of-Class Hours: 105
4. Total Student Learning Hours: 262.5

C. Prerequisites, Corequisites, Advisories, and Limitations on Enrollment:

Prerequisites
Current:
CHEM R110: Elementary Chemistry and
MATH R015: Beginning and Intermediate Algebra or
MATH R005: Beginning and Intermediate Algebra for Statistics and Liberal Arts or
MATH R014: Intermediate Algebra or
MATH R033: Pathway to STEM or
Placement as determined by the college's multiple measures assessment process

Previous:
CHEM R110: Elementary Chemistry and
MATH R014: Intermediate Algebra or
MATH R033: Pathway to STEM

Corequisites
Current: None
Previous:

Advisories:
Current: None
Previous:

Limitations on Enrollment:
Current: None
Previous:

D. Catalog description:
Current:
This course studies fundamental principles and theories of chemistry with special emphasis on calculations of solution chemistry, stoichiometry, chemical equilibrium and oxidation-reduction; includes discussion of quantum mechanical model of the atom, kinetic-molecular theory, and periodic table. Lab is designed to develop quantitative relationships through experiments, and to introduce inorganic preparative procedures and computer analysis of data.
Previous, if different:

E. Fees:
Current: $ None
Previous, if different: $

F. Field trips:
Current:
Will be required: [ ]
May be required: [X]
Will not be required: [ ]

Previous, if different:
Will be required: [ ]
May be required: [ ]
Will not be required: [ ]

G. Repeatability:
Current:
A - Not designed as repeatable
Previous:
A - Not designed as repeatable

H. Credit basis:
Current:
Letter graded only [X]
Pass/no pass [ ]
Student option [ ]

Previous, if different:
Letter graded only [ ]
Pass/no pass [ ]
Student option [ ]

I. Credit by exam:
Current:
Petitions may be granted: [ ]
Petitions will not be granted: [X]

Previous, if different:
Petitions may be granted: [ ]
Petitions will not be granted: [ ]

III. Course Objectives:
Upon successful completion of this course, the student should be able to:

A. Perform conversions in the metric system using memorized conversions and the technique of dimensional analysis.
B. Write the names and symbols of common elements. Name or give the formulas of simple inorganic compounds.
C. Write and balance chemical equations including net-ionic equations.
D. Perform stoichiometric calculations based on chemical formulas and balanced chemical equations.
E. Describe the structure of the atom according to Rutherford's Experiment and Bohr's Theory. Give the modern wave mechanical view of the atom in terms of electronic orbitals.
F. Relate periodic properties to electronic configurations of the elements.
G. Give the four quantum numbers of an electron in a particular atomic orbital, and their role in describing the location and energy of the electron.
H. Describe covalent and ionic bonding in terms of Lewis Dot Theory, Valance Bond Hybridization, and VSER (Valence Shell Electron Pair Repulsion). Relate chemical and physical properties to bonding and structure.
I. Identify acids, bases, and salts. Describe solutions of strong, weak, and non-electrolytes. Predict and balance ionic reactions involving precipitation, displacement, and neutralization.
J. Perform thermodynamics calculations involving calorimetry, Hess's Law, and heat of formation.
K. Describe gases, liquids, and solids and perform calculations involving these three phases. Relate properties of each to Kinetic Molecular Theory and intermolecular forces.
L. Discuss solutions and factors governing solubility. Perform calculations involving concentration units, especially dilution and neutralization.

M. Use the concept of equilibrium and equilibrium constant to describe and perform calculations on equilibrium systems, especially in the gas phase. Apply Le Chatelier's Principle to predict response of equilibrium system to perturbations in concentration, temperature, and pressure.

IV. Student Learning Outcomes:

A. Use the ideal gas equation to calculate volume, pressure, temperature, or quantity of a gas when data given or collected.

B. Perform thermodynamic calculations involving calorimetry, Hess's law, and heat information. Students will become proficient at using the table of thermodynamic values, specifically heats of formation.

C. Describe covalent and ionic bonding in terms of Lewis Dot Structure, valence bond hybridization, and VSEPR (valence shell electron pair repulsion) theory. Relate chemical and physical properties to bonding and structure.

V. Course Content:

Topics to be covered include, but are not limited to:

A. Basic
    1. Math review—dimensional analysis, significant figures, and scientific notation
    2. Chemistry review—composition of the atom, atomic symbols, chemistry formulas, nomenclature, chemical reactions

B. Mole Concept
    1. Conversions among number of atoms/molecules, mass and numbers of moles

C. Stoichiometry
    1. Weight percent, formula weight, empirical and molecular formulas
    2. Combining weights, yield, percent yield, limiting reactants

D. Solutions
    1. Concentrations, dilution/titration calculations, electrolytes, nonelectrolytes, acids, bases, salts
    2. Reaction types, net ionic equations, stoichiometry with solutions

E. Thermochemistry
    1. First Law, system/surrounding, heat/work, units, calorimetry
    2. Enthalpy, Hess's Law, heat of formation

F. Atomic Theory
    1. Historic background, Bohr atom and atomic spectroscopy
    2. Quantum mechanical atom, quantum numbers, orbitals, energy levels, electron configuration
    3. Correlation of electron configuration with molecular properties

G. Bonding
    1. Lewis dots, octet rule, ionic and covalent bonding, resonance, electronegativity and polarity
    2. VSEPR (Valence Shell Electron Pair Repulsion) Theory, molecular geometry, molecular polarity

H. Gases
    1. Ideal gas laws, Boyle's, Charles's, Avogadro's, Combined Laws, gas mixtures, stoichiometry of gases
    2. KMT (Kinetic Molecular Theory)

I. Liquids and Solids
    1. Inter-particle forces, phase changes, colligative properties, structure of liquids and solids

J. Equilibrium

1. Gas phase equilibria, equilibrium constants and concentrations, heterogeneous equilibria, Le Chatelier's Principle
2. Ionization of water, pH concept, pH of strong acids and bases

VI. Lab Content:

A. Graphing and Exponential Notation
   1. Written exercises in graphing various relationships
   2. Written exercises in determining significant figures in mathematical operations
   3. Written exercises in use of exponential notation

B. Nomenclature and Formula Writing
   1. Writing chemical formulas from chemical names and chemical names from chemical formulas
   2. Reaction types defined and reactions written and balanced

C. Determination of an Empirical formula
   1. Experimental determination of the formula for a chloride of manganese
   2. Use of evaporating dish and burner to dissolve Mn sample in HCl
   3. Dried product is weighed and formula calculated from initial and final masses
   4. Use of desiccator is learned

D. Stoichiometry and Limiting Reactants
   1. Written exercises in use of balanced equations to calculate quantities products formed from given quantities of reactants

E. Writing Net Ionic Equations
   1. Written exercises in predicting whether a reaction takes place from the mixing of given reactants
   2. Writing balanced total molecular, total ionic and net ionic equations when a reaction takes place

F. Formulation of the Activity Series
   1. Reactions observed between metals and acids, and metals and metal salt solution
   2. Activity series developed on the basis of observations in #1 above
   3. Net ionic equations written to describe chemical reactions

G. Study of Thermochemistry
   1. Heat of neutralization determined by measuring the temperature change during the reaction of an acid solution with a base solution
   2. Heat of solution determined by measuring the temperature change during the dissolving of a base in water
   3. Heat of neutralization determined by measuring the temperature change during the reaction of an acid solution with a solid bas e
   4. Heats of reaction determined using computer interface and temperature probe
   5. Hess's Law is verified by manipulation heats of reactions determined in #1, 2, and 3 above

H. Analysis of the Hydrogen Spectrum
   1. Three lines of the Balmer Series of the hydrogen spectrum are measured using a spectroscope
   2. Angles are converted to wavelengths of light, then to corresponding energy
   3. Rydberg equation is used to convert energy of transition of electron to the corresponding initial principle energy level and final principle energy level

I. Chemical in Everyday Life are Examined
   1. Specific tests are learned used to identify cations and anions found in chemicals used daily
   2. Tests learned are used to identify cations and anions in unknown salts

J. Quantitative Analysis of a Mixture

1. Mixture of two compounds is analyzed by decomposing one of the compounds using a burner and a crucible
2. Stoichiometric calculation is done to determine percent of the compound in the mixture

K. Use of Molecular Models to Predict Molecular Shape and Polarity
1. Lewis dot structures are drawn in a written exercise in order to build models
2. Molecular models are used to show geometric shape of molecules and bond angles
3. Molecular polarity is predicted using electronegativities and vector forces

L. Determination of the Molar Mass of a volatile Liquid
1. Sample of volatile liquid is vaporized using a flask and boiling water
2. Volume, temperature, and pressure of the gas is measured
3. Molar mass of the gas is calculated using the ideal gas equation

M. Gas Stoichiometry Examined
1. Magnesium sample is reacted with hydrochloric acid
2. Hydrogen gas generated is collected over water in a gas collection tube
3. Ideal gas equation is used to calculate moles of hydrogen
4. Stoichiometry of the balanced equation used to calculate mass of Mg in sample

N. Volumetric Analysis using Acid-Base Titration
1. Base solution is standardized against a standard acid using buret, flasks and indicator
2. Unknown acid solution is titrated using the standard base, buret and volumetric pipet
3. Normalities of base solution and unknown acid solutions are calculated

O. Study of Colligative Properties
1. Cooling curve for a solvent is graphed from a temperature and time data
2. Cooling curve for a solution of an unknown substance dissolved in the solvent is graphed using temperature and time data
3. Freezing point depression relationship is used to calculate the molarity of the unknown
4. Molarity of the unknown is used to calculate the molar mass of the unknown

P. Le Chatelier's Principle Studied
1. Several reactions examined that illustrate the shifting of the position of equilibrium when stresses are placed on a reaction at equilibrium
2. Direction of shift is determined based on the given stress on the equilibrium

Q. Use of Indicators to Determine pH
1. Buffers of pH values 1 - 12 are used to prepare color standards with several indicators
2. Standards are used to determine the pH of solutions of unknown pH

VII. Methods of Instruction:

Methods may include, but are not limited to:

A. Instructors will lecture on the general properties of the matter, phase change, define the different kinds of reactions, describe the properties of solution, perform conversions in the metric system using memorized conversions and the technique of dimensional analysis, write the names and symbols of common elements and compounds, write and balance chemical equations including net-ionic equations.

B. Instructors will discuss the structure of the atom according to Rutherford's Experiment and Bohr's Theory, the modern wave mechanical view of the atom in terms of electronic orbitals related with periodic properties to electronic configurations of the elements, four quantum numbers of an electron in a particular atomic orbital, and their role in describing the location and energy of the electron.

C. Instructors will demonstrate with the molecular models in the classroom to illustrate the molecular shape with the explanation of VSEPR (Valence Shell Electron Pair Repulsion) Theory, bond type and polarity of the molecules.

D. Instructors will demonstrate the use the calculator for the proper stoichiometric calculation and pH calculation, thermodynamics calculation involving calorimetry, Hess's Law, and heat of formation, concentration units, especially dilution and neutralization, and equilibrium systems.

E. Instructors will demonstrate the basic lab techniques in order for students to perform the titration in the lab. Instruments such as pH meter and thermometer are simulated using probes connected to laptop computers.

VIII. Methods of Evaluation and Assignments:

A. Methods of evaluation for degree-applicable courses:

Essays [X]
Problem-solving assignments (Examples: Math-like problems, diagnosis & repair) [X]
Physical skills demonstrations (Examples: Performing arts, equipment operation) [X]

For any course, if "Essays" above is not checked, explain why.

B. Typical graded assignments (methods of evaluation):

1. Lecture: Quizzes and exams are graded on the basis of correct answers, inclusion of units for all measurements, correct mathematical set up using dimensional analysis, correct number of significant figures. Where written answers are required grading is based on correctness of answer, correct use of chemical terminology, spelling, punctuation and grammar.

2. Lab: Lab quizzes are graded on the basis of correct answers, inclusion of units for all measurements, correct mathematical set up using dimensional analysis, correct number of significant figures. Lab experiments are graded on the basis of correct use of equipment in obtaining the measurements to the correct number of significant figures. Where written answers are required grading is based on correctness of answer, correct use of chemical terminology, spelling, punctuation, and grammar.

3. Quizzes will be given regularly on the topics related in the lecture and exercises at the end of every chapter, such as unit conversion or the names and symbols of the elements or compounds.
4. Exams will be given the materials accumulated in every three or four chapter of textbook, include atomic structure, sub-particles, molecular structure, chemical reactions, stoichiometry, molecular shapes.
5. Final Test will be conducted on the scheduled day according to semester schedule. It will be comprehensive with definition of atom, molecule, compound, changes, calculation of different units, mole-mass, gas properties, VSEPR Theory, solution stoichiometry, equilibrium constant, etc.
6. All the lab work results in the production of lab reports including significant figures in math operation, nomenclature, stoichiometry, chemical equations including net ionic equations, single replacement, thermochemistry, properties of common household chemicals, molecular models, properties of gas and solution, titration of acid and base, equilibrium with the application of Le Chatelier's Principle.

C. Typical outside of classroom assignments:

1. Reading
    a. Textbook and Lab Manual
    b. Professional Journals, such as Journal of Chemical and Engineering News, published by America Chemical Society.
    c. Internet, such as www.acs.org, www.chemweb.com, http://ocw.mit.edu/OcwWeb/Chemistry/, www.anytimetutor.com
2. Writing
    a. Students answer the questions at the end of each chapter related with the electron configuration to the periodic table, and explain the metallic and non-metallic characters based on valence electrons, stoichiometry, thermochemistry, equilibrium constant calculation.
    b. Students write essays to describe the properties of acid, base, and neutral solutions.
    c. Students enter the data collected in the lab period, and give the explanation of the activities of metals. Students are required to write a formal lab report related with the Hess's Law.
3. Other
    a. Encourage students to form a studying group and work together to understand the chemical equilibrium.
    b. Help students individually in instructor's office to help on homework related to chemical properties.

IX. Textbooks and Instructional Materials:
  A. Textbooks/Resources:
    1. Brown, LeMay, and Bursten (2015). *Chemistry—the Central Science* (13th /e). Pearson/Prentice Hall.
    2. L Crockett (2015). *Chem R120 Laboratory Manual* (Revised /e). XanEdu.
  B. Other instructional materials:
    1. Scientific calculator
    2. Safety goggles
    3. Duplicate Notebook

X. Minimum Qualifications and Additional Certifications:
  A. Minimum qualifications:
    1. Chemistry (Masters Required)
  B. Additional certifications:
    1. Description of certification requirement:
    2. Name of statute, regulation, or licensing/certification organization requiring this certification:

XI. Approval Dates
Curriculum Committee Approval Date: 11/14/2018
Board of Trustees Approval Date: 11/14/2018
State Approval Date:
Catalog Start Date: Fall 2019