New Mexico Common Chemistry Courses
December 2017

New Mexico Higher Education Department
# Members of the Chemistry Common Course Numbering Subcommittee

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<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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<tr>
<td>Carol Martinez</td>
<td>CNM</td>
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<tr>
<td>James Finley</td>
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<td>Jeff Altig</td>
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<td>Azher Saleh</td>
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<td>Bill Adams</td>
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<td>Lisa Whalen</td>
<td>UNM</td>
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<td>Kamala Sharma</td>
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New Mexico Common Chemistry Courses
The following courses were determined to be equivalent courses based on a review of course description and student learning outcomes in the course syllabus. This review was completed by a faculty committee.
Chemistry in Our Community – 100 level

Includes:
CNM CHEM 1010
ENMU CHEM 113
UNM CHEM 101

Course Description:
This course will introduce non-science majors to the basic chemistry required to understand topics of current interest affecting their communities, such as air and water quality, global climate change, use of fossil fuels, nuclear power, and alternative energy sources, to illustrate chemical principles, acquaint students with scientific methods, and to critically evaluate scientific claims as presented in the media and in other communicative forums.

Student Learning Outcomes:
1. Define and explain basic chemical terms, principles and concepts.
2. Recognize simple compounds.
3. Utilize the scientific method to analyze arguments.
4. Interpret information from data presented in charts, graphs, tables and spreadsheets.
5. Balance chemical and nuclear reactions and solve simple stoichiometry problems.
6. Analyze the quality of an argument provided in support of a position.
7. Identify reliable government and scientific websites for accessing data relevant to current local, national and international issues.
8. Understand and explain the basic chemistry behind and major issues of debate concerning topics such as air and water quality, global climate change, use of fossil fuels, nuclear power, and alternative energy sources.
Chemistry in Our Community Laboratory – 100 level

Includes:
  CNM CHEM 1092
  ENMU CHEM 113L

Course Description:
This course will introduce non-science majors to the basic chemistry required to understand topics of current interest affecting their communities, such as air and water quality, global climate change, use of fossil fuels, nuclear power, and alternative energy sources. Experiments will illustrate chemical principles and acquaint students with scientific methods, data processing, critical thinking and scientific writing.

Student Learning Outcomes:
1. Define and explain basic chemical terms, principles and concepts.
2. Evaluate safety issues in chemical reactions, laboratories and industry.
3. Observe the operation of laboratory equipment to collect data and as used in industry.
4. Discuss chemical reactions that take place in various environments and their effects on air and water quality, climate change, nuclear power, fossil fuels, and alternative energy sources.
5. Discuss the use and harmful effects of chemicals to the environment, including the importance of safe disposal of toxic chemicals.
6. Examine the effects of public policy on environment.
7. Examine how energy production affects climate change, including basic calculations.
8. Interpret information from data represented in charts, graphs, tables and spreadsheets.
Chemistry in Our Community Lecture and Laboratory – 100 level

Includes:
ENMU Ru CHEM 113
NMHU CHEM 100 – please submit SLOs

Course Description:
This course will introduce non-science majors to the basic chemistry required to understand topics of current interest affecting their communities, such as air and water quality, global climate change, use of fossil fuels, nuclear power, and alternative energy sources. Experiments will illustrate chemical principles and acquaint students with scientific methods, data processing, critical thinking and scientific writing.

Lecture Student Learning Outcomes:
1. Define and explain basic chemical terms, principles and concepts.
2. Recognize simple compounds.
3. Utilize the scientific method to analyze arguments.
4. Interpret information from data presented in charts, graphs, tables and spreadsheets.
5. Balance chemical and nuclear reactions and solve simple stoichiometry problems.
6. Analyze the quality of an argument provided in support of a position.
7. Identify reliable government and scientific websites for accessing data relevant to current local, national and international issues.
8. Understand and explain the basic chemistry behind and major issues of debate concerning topics such as air and water quality, global climate change, use of fossil fuels, nuclear power, and alternative energy sources.

Laboratory Student Learning Outcomes:
1. Define and explain basic chemical terms, principles and concepts.
2. Evaluate safety issues in chemical reactions, laboratories and industry.
3. Observe the operation of laboratory equipment to collect data and as used in industry.
4. Discuss chemical reactions that take place in various environments and their effects on air and water quality, climate change, nuclear power, fossil fuels, and alternative energy sources.
5. Discuss the use and harmful effects of chemicals to the environment, including the importance of safe disposal of toxic chemicals.
6. Examine the effects of public policy on environment.
7. Examine how energy production affects climate change, including basic calculations.
8. Interpret information from data represented in charts, graphs, tables and spreadsheets.
General Chemistry I for STEM Majors – 100 level

Includes:
- CNM CHEM 1710
- ENMU CHEM 151
- NMHU CHEM 211
- NMT CHEM 121
- NNMC CHEM 121
- SFCC CHEM 121
- SIPI CHEM 121
- UNM CHEM 121
- UNM G CHEM 121
- UNM LA CHEM 121
- UNM T CHEM 121
- UNM V CHEM 121

Course Description:
This course is intended to serve as an introduction to General Chemistry for students enrolled in science, engineering, and certain pre-professional programs. Students will be introduced to several fundamental concepts, including mole, concentration, heat, atomic and molecular structure, periodicity, bonding, physical states, stoichiometry, and reactions.

Student Learning Outcomes:
1. Use dimensional analysis, the SI system of units and appropriate significant figures to solve quantitative calculations in science.
2. Explain the structure of atoms, isotopes and ions in terms of subatomic particles.
3. Understand the differences between physical and chemical changes to matter, and utilize the IUPAC system of nomenclature and knowledge of reaction types to describe chemical changes, predict products and represent the process as a balanced equation.
4. Apply the mole concept to amounts on a macroscopic and a microscopic level and use this to perform stoichiometric calculations including for reactions in solution, gases and thermochemistry.
5. Apply the gas laws and kinetic molecular theory to relate atomic level behavior to macroscopic properties.
6. Describe the energy conversions that occur in chemical reactions and state changes, relating heat of reaction to thermodynamic properties such as enthalpy and internal energy, and apply these principles to measure and calculate energy changes in reaction.
7. Use different bonding models to describe formation of compounds (ionic and covalent), and apply knowledge of electronic structure to determine molecular spatial arrangement and polarity.
8. Analyze how periodic properties (e.g. electronegativity, atomic and ionic radii, ionization energy, electron affinity, metallic character) and reactivity of elements results from electron configurations of atoms.
**General Chemistry I Laboratory for STEM Majors – 100 level**

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<td>CNM</td>
<td>CHEM 1792</td>
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**Course Description:**

General Chemistry I Laboratory for Science Majors is the first-semester laboratory course designed to complement the theory and concepts presented in General Chemistry I lecture. The laboratory component will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

**Student Learning Outcomes:**

1. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
2. Demonstrate the computational skills needed to perform appropriate laboratory related calculations to include, but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.
3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
4. Prepare solutions with an acceptable accuracy to a known concentration using appropriate glassware.
5. Master basic laboratory techniques including, but not limited to weighing samples (liquid and solid), determining sample volumes, measuring the temperature of samples, heating and cooling a sample or reaction mixture, decantation, filtration, and titration.
6. Demonstrate mastery in experimental techniques, such as pressure measurements, calorimetric measurements, and spectrophotometric measurements.
7. Draw conclusions based on data and analyses from laboratory experiments.
8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
9. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.
10. Design experimental procedures to study chemical phenomena.
General Chemistry I Lecture and Laboratory for STEM Majors – 100 level

Includes:
- LUNA CHEM 111
- NMJC CHEM 114A
- SJC CHEM 111
- MCC CHEM 115
- NMSU CHEM 115

Course Description:
This course is intended to serve as an introduction to General Chemistry for students enrolled in science, engineering, and certain pre-professional programs. Students will be introduced to several fundamental concepts, including mole, concentration, heat, atomic and molecular structure, periodicity, bonding, physical states, stoichiometry, and reactions. The laboratory component is designed to complement the theory and concepts presented in lecture, and will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

Lecture Student Learning Outcomes:
1. Use dimensional analysis, the SI system of units and appropriate significant figures to solve quantitative calculations in science.
2. Explain the structure of atoms, isotopes and ions in terms of subatomic particles.
3. Understand the differences between physical and chemical changes to matter, and utilize the IUPAC system of nomenclature and knowledge of reaction types to describe chemical changes, predict products and represent the process as a balanced equation.
4. Apply the mole concept to amounts on a macroscopic and a microscopic level and use this to perform stoichiometric calculations including for reactions in solution, gases and thermochemistry.
5. Apply the gas laws and kinetic molecular theory to relate atomic level behavior to macroscopic properties.
6. Describe the energy conversions that occur in chemical reactions and state changes, relating heat of reaction to thermodynamic properties such as enthalpy and internal energy, and apply these principles to measure and calculate energy changes in reaction.
7. Use different bonding models to describe formation of compounds (ionic and covalent), and apply knowledge of electronic structure to determine molecular spatial arrangement and polarity.
8. Analyze how periodic properties (e.g. electronegativity, atomic and ionic radii, ionization energy, electron affinity, metallic character) and reactivity of elements results from electron configurations of atoms.

Laboratory Student Learning Outcomes:
1. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
2. Demonstrate the computational skills needed to perform appropriate laboratory-related calculations to include, but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.
3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
4. Prepare solutions with an acceptable accuracy to a known concentration using appropriate glassware.
5. Master basic laboratory techniques including, but not limited to weighing samples (liquid and solid), determining sample volumes, measuring the temperature of samples, heating and cooling a sample or reaction mixture, decantation, filtration, and titration.
6. Demonstrate mastery in experimental techniques, such as pressure measurements, calorimetric measurements, and spectrophotometric measurements.
7. Draw conclusions based on data and analyses from laboratory experiments.
8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
9. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.
10. Design experimental procedures to study chemical phenomena.
General Chemistry II for STEM Majors – 100 level

Includes:

- CNM CHEM 1810
- ENMU CHEM 152
- NMHU CHEM 212
- NMT CHEM 122
- NNMC CHEM 122
- SFCC CHEM 122
- SIPI CHEM 122
- UNM CHEM 122
- UNM CHEM 132
- UNMG CHEM 122
- UNMLA CHEM 122
- UNMV CHEM 122

Course Description:
This course is intended to serve as a continuation of general chemistry principles for students enrolled in science, engineering, and certain pre-professional programs. The course includes, but is not limited to a theoretical and quantitative coverage of solutions and their properties, kinetics, chemical equilibrium, acids and bases, entropy and free energy, electrochemistry, and nuclear chemistry. Additional topics may include (as time permits) organic, polymer, atmospheric, and biochemistry.

Student Learning Outcomes:

1. Explain the intermolecular attractive forces that determine physical properties and phase transitions, and apply this knowledge to qualitatively evaluate these forces from structure and to predict the physical properties that result.
2. Calculate solution concentrations in various units, explain the effects of temperature, pressure and structure on solubility, and describe the colligative properties of solutions, and determine solution concentrations using colligative property values and vice versa.
3. Explain rates of reaction, rate laws, and half-life, determine the rate, rate law and rate constant of a reaction and calculate concentration as a function of time and vice versa, as well as explain the collision model of reaction dynamics and derive a rate law from a reaction mechanism, evaluating the consistency of a mechanism of a given rate law.
4. Describe the dynamic nature of chemical equilibrium and its relation to reaction rates, and apply Le Chatelier’s Principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures as well as describe the equilibrium constant and use it to determine whether equilibrium has been established, and calculate equilibrium constants from equilibrium concentrations and vice versa.
5. Describe the different models of acids and base behavior and the molecular basis for acid strength, as well as apply equilibrium principles to aqueous solutions, including acid-base and solubility reactions, and calculate pH and species concentrations in buffered and unbuffered solutions.
6. Explain titration curves and speciation diagrams, as well as calculate concentrations of reactants from the former and determine dominant species as a function of pH from the latter.
7. Explain and calculate the thermodynamic functions, enthalpy, entropy and Gibbs free energy, for a chemical system, and relate these functions to equilibrium constants and reaction spontaneity; balance redox equations, express them as two half reactions and evaluate the potential, free energy and equilibrium K for the reaction, as well as predict the spontaneous direction.
8. Construct a model of a galvanic or electrolytic cell; or describe organic reactions.
9. Describe bonding theories, such as valence and molecular orbital theory.
General Chemistry II Laboratory for STEM Majors – 100 level

Includes:

- CNM CHEM 1892
- ENMU CHEM 152L
- ENMU Ro CHEM 152L
- NNMC CHEM 122L
- SFCC CHEM 122L
- SIPI CHEM 122L
- UNM CHEM 124L
- UNM G CHEM 124L
- UNM LA CHEM 124L
- UNM V CHEM 124L

Course Description:
General Chemistry II Laboratory for Science Majors is the second of a two-semester sequence of laboratory courses designed to complement the theory and concepts presented in General Chemistry II lecture. The laboratory component will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

Student Learning Outcomes:
1. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
2. Demonstrate the computational skills needed to perform appropriate laboratory-related calculations to include, but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.
3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
4. Prepare solutions with an acceptable accuracy to a known concentration using appropriate glassware.
5. Perform basic laboratory operations related to, but not limited to, gas behavior, colligative properties of solutions, calorimetry, chemical kinetics, chemical equilibria, acid/base titrations, electrochemistry, metal reactivity, and qualitative analyses of ions.
6. Draw conclusions based on data and analyses from laboratory experiments.
7. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes, as required.
8. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.
9. Design experimental procedures to study chemical phenomena.
General Chemistry II Lecture and Laboratory for STEM Majors – 100 level

Includes:
- ENMU Ru CHEM 152
- NMJC CHEM 124A
- SJC CHEM 112

Course Description:
This course is intended to serve as a continuation of general chemistry principles for students enrolled in science, engineering, and certain pre-professional programs. The course includes, but is not limited to a theoretical and quantitative coverage of solutions and their properties, kinetics, chemical equilibrium, acids and bases, entropy and free energy, electrochemistry, and nuclear chemistry. Additional topics may include (as time permits) organic, polymer, atmospheric, and biochemistry. The laboratory component is designed to complement the theory and concepts presented in lecture, and will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

Lecture Student Learning Outcomes:
1. Explain the intermolecular attractive forces that determine physical properties and phase transitions, and apply this knowledge to qualitatively evaluate these forces from structure and to predict the physical properties that result.
2. Calculate solution concentrations in various units, explain the effects of temperature, pressure and structure on solubility, and describe the colligative properties of solutions, and determine solution concentrations using colligative property values and vice versa.
3. Explain rates of reaction, rate laws, and half life, determine the rate, rate law and rate constant of a reaction and calculate concentration as a function of time and vice versa, as well as explain the collision model of reaction dynamics and derive a rate law from a reaction mechanism, evaluating the consistency of a mechanism of a given rate law.
4. Describe the dynamic nature of chemical equilibrium and its relation to reaction rates, and apply LeChatelier’s Principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures as well as describe the equilibrium constant and use it to determine whether equilibrium has been established, and calculate equilibrium constants from equilibrium concentrations and vice versa.
5. Describe the different models of acids and base behavior and the molecular basis for acid strength, as well as apply equilibrium principles to aqueous solutions, including acid base and solubility reactions, and calculate pH and species concentrations in buffered and unbuffered solutions.
6. Explain titration curves and speciation diagrams, as well as calculate concentrations of reactants from the former and determine dominant species as a function of pH from the latter.
7. Explain and calculate the thermodynamic functions, enthalpy, entropy and Gibbs free energy, for a chemical system, and relate these functions to equilibrium constants and reaction spontaneity; balance redox equations, express them as two half reactions and evaluate the potential, free energy and equilibrium K for the reaction, as well as predict the spontaneous direction.
8. Construct a model of a galvanic or electrolytic cell; or describe organic reactions.
9. Describe bonding theories, such as valence and molecular orbital theory.

Laboratory Student Learning Outcomes:
1. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.

2. Demonstrate the computational skills needed to perform appropriate laboratory related calculations to include, but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.

3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).

4. Prepare solutions with an acceptable accuracy to a known concentration using appropriate glassware.

5. Perform basic laboratory operations related to, but not limited to, gas behavior, colligative properties of solutions, calorimetry, chemical kinetics, chemical equilibria, acid/base titrations, electrochemistry, metal reactivity, and qualitative analyses of ions.

6. Draw conclusions based on data and analyses from laboratory experiments.

7. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes, as required.

8. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.

9. Design experimental procedures to study chemical phenomena.
Integrated Organic Chemistry and Biochemistry – 200 level

Includes:
- CNM CHEM 2210
- DACC CHEM 210
- NNMC CHEM 210
- SFCC CHEM 212 (has a co-requisite, unique lab)
- SIPI CHEM 212
- UNM CHEM 212
- UNM G CHEM 212
- UNM LA CHEM 212
- UNMV CHEM 212

Course Description:
This course is a one-semester introduction to Organic Chemistry and Biochemistry designed for students in health and environmental occupations. The course surveys organic compounds in terms of structure, physical, and chemical properties, followed by coverage of the chemistry of specific classes of organic compounds in the biological environment. Students will apply course concepts to everyday organic and biological chemistry problems in preparation for careers in health and environmental fields.

Student Learning Outcomes:
1. Identify and name basic organic compounds.
2. Construct/draw organic compounds from the names.
3. Predict the products of certain organic chemical reactions from reagents and conditions presented.
4. Recognize and name the four basic bioorganic units and certain of their derivatives and macromolecules.
5. Compare and contrast the function and location of the four bioorganic units and their macromolecules and cofactors.
6. Draw/recognize stereochemistry and explain its relevance to bioorganic molecules.
7. Discuss the pathways and functions of some of the cellular metabolic processes.
8. Recognize and describe metabolic cellular processes and macromolecular structure with respect to health and/or disease states.
Introduction to Chemistry – 100 level

Includes:

- CNM CHEM 1410
- ENMU Ro CHEM 121
- NMMI CHEM 1104
- NNMC CHEM 110
- SFCC CHEM 111
- SIPI CHEM 111
- UNM CHEM 111 (also has recitation)

Course Description:
This course covers qualitative and quantitative areas of non-organic general chemistry for nonscience majors and some health professions. Students will learn and apply principles pertaining, but not limited to, atomic and molecular structure, the periodic table, acids and bases, mass relationships, and solutions.

Student Learning Outcomes:

1. Use the different systems of measurements and perform conversions within the same system of measurement and between different systems of measurements.
2. Identify elements from their name or symbol, use the periodic table to describe reactivity patterns of elements and to predict compound formation.
3. Describe the basic structure of an atom using subatomic particles, and apply these concepts to nuclear reactions.
4. Describe ion formation and the difference between covalent and ionic compounds. Name and write formulas for ionic and simple molecular compounds.
5. Write and balance chemical reactions. Use balanced reactions in stoichiometric calculations.
6. Describe the differences between the solid, liquid and gas phases. Use the gas laws in calculations, and apply these laws to everyday situations.
7. Explain different types of energy, and how energy is released or absorbed in a reaction.
8. Describe acid and base behavior and the nature of buffer solutions.
Introduction to Chemistry Laboratory – 100 level

Includes:
- CNM CHEM 1492
- NMSU A CHEM 110
- NNMC CHEM 110L
- SFCC CHEM 111L
- SIPI CHEM 111L
- WNMU CHEM 123

Course Description:
Introduction to Chemistry Laboratory is a laboratory course designed to complement the theory and concepts presented in the Introduction to Chemistry lecture component, and will introduce students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

Student Learning Outcomes:
1. Practice concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
2. Demonstrate the computational skills needed to perform appropriate laboratory related calculations to include, but not be limited to determining the number of significant figures in numerical value, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.
3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
4. Record quantitatively measured values to the correct number of significant figures and assign the correct units.
5. Master basic laboratory techniques including, but not limited to weighing samples (liquid and solid), determining sample volumes, measuring the temperature of samples, heating and cooling a sample or reaction mixture, decantation, filtration, and titration.
6. Draw appropriate conclusions based on data and analyses.
7. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
8. Determine chemical formulas and classify different types of reactions.
9. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.
Introduction to Chemistry Lecture and Laboratory – 100 level

Includes:
  DACC CHEM 110G
  NMJC CHEM 1114
  NMSUC CHEM 110G
  SJC CHEM 110
  UNM G CHEM 111

Course Description:
This course covers qualitative and quantitative areas of non-organic general chemistry for non-science majors and some health professions. Students will learn and apply principles pertaining, but not limited to, atomic and molecular structure, the periodic table, acids and bases, mass relationships, and solutions. The laboratory component introduces students to techniques for obtaining and analyzing experimental observations pertaining to chemistry using diverse methods and equipment.

Lecture Student Learning Outcomes:
1. Use the different systems of measurements and perform conversions within the same system of measurement and between different systems of measurements
2. Identify elements from their name or symbol, use the periodic table to describe reactivity patterns of elements and to predict compound formation.
3. Describe the basic structure of an atom using subatomic particles, and apply these concepts to nuclear reactions.
4. Describe ion formation and the difference between covalent and ionic compounds. Name and write formulas for ionic and simple molecular compounds.
5. Write and balance chemical reactions. Use balanced reactions in stoichiometric calculations.
6. Describe the differences between the solid, liquid and gas phases. Use the gas laws in calculations, and apply these laws to everyday situations.
7. Explain different types of energy, and how energy is released or absorbed in a reaction
8. Describe acid and base behavior.
9. Explain the intermolecular attractive forces that determine physical properties; apply this knowledge to qualitatively evaluate these forces and predict the physical properties that result.
10. Explain the intermolecular attractive forces that determine physical properties; apply this knowledge to qualitatively evaluate these forces and predict the physical properties that result

Laboratory Student Learning Outcomes:
1. Practice concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
2. Demonstrate the computational skills needed to perform appropriate laboratory-related calculations to include, but not be limited to determining the number of significant figures in numerical value, solving problems using values represented in exponential notation, solving dimensional analysis problems, and manipulating mathematical formulas as needed to determine the value of a variable.
3. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
4. Record quantitatively measured values to the correct number of significant figures and assign the correct units.
5. Master basic laboratory techniques including, but not limited to weighing samples (liquid and solid), determining sample volumes, measuring the temperature of samples, heating and cooling a sample or reaction mixture, decantation, filtration, and titration.
6. Draw appropriate conclusions based on data and analyses.
7. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
8. Determine chemical formulas and classify different types of reactions.
9. Relate laboratory experimental observations, operations, calculations, and findings to theoretical concepts presented in the complementary lecture course.
Survey of Organic Chemistry and Laboratory – 200 level

Includes:
- NMSU CHEM 211
- NMSU C CHEM 211
- SJC CHEM 210

Course Description:
This course is a one-semester survey of organic and biological chemicals. Students will be introduced to nomenclature, molecular structure, properties, and reactions of hydrocarbons, alcohols, carbonyls, organic acids and bases, carbohydrates, lipids, and proteins. The handling of organic chemicals, simple organic reactions, tests for functional groups, and synthesis will be learned in the laboratory component of this course.

Student Learning Outcomes:
1. Identify common organic functional groups.
2. Translate between the IUPAC names and structures of simple organic molecules.
3. Predict the products of certain organic chemical reactions from reagents and conditions presented.
4. Predict physical and chemical behavior of organic molecules based on structure.
5. Synthesize several classes of organic compounds in the laboratory that were previously studied in the lecture component of this course.
6. Recognize and name the four basic bioorganic units and certain of their derivatives and macromolecules.
7. Construct 3 dimensional models of organic compounds.
8. Understand and apply safety principles associated with Organic Chemistry laboratory operations and activities.
9. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
10. Draw/recognize stereochemistry and explain its relevance to bioorganic molecules.
Unique Chemistry Courses

The following courses are offered at a single institution or system. The course description and student learning outcomes from that institution or system were adopted as those for the common course numbering system.
Chemistry for General Education and Lab – 100 level
CCC CHEM 113

Course Description:
This course serves as an introduction to Chemistry for non-science majors. It is a general survey of chemistry that investigates chemical concepts including matter and its changes, atomic structure, compound formulas, chemical reactions and equations, and stoichiometry.

Student Learning Outcomes:
Upon completion of this course, the student will be able to:
1. Develop an understanding of the history of chemistry and the development of chemistry as a science.
2. Classify matter as an element, compound, or mixture.
3. Describe the arrangement of basic subatomic particles and extend that information to understand differences in mass, stability, and reactivity of elements.
4. Using the Periodic Table of Elements, distinguish between metals, non-metals, and metalloids as well as outer shell (valence) electron arrangement.
5. Relate quantitative aspects of reaction and stoichiometry.
6. Describe three broad categories of biochemical: carbohydrates, lipids, and proteins.
Course Description:
This course is an introduction to the basic laws and principles of general chemistry including atoms, molecules, ions, chemical formulas and equations, periodicity, and atomic structure. It will also introduce basic scientific concepts in scientific literacy such as the scientific method and scientific critical thinking. Laboratory exercises are included in this course. This is the first course in a two-semester sequence.

Student Learning Outcomes:
By the end of this course, students should achieve at least 70% proficiency in the following:

1. Describe the fundamentals of matter and the changes that occur in matter.
2. Describe the fundamentals of chemical names and formulas
3. Write and balance basic chemical equations
4. Solve basic problems in stoichiometry
5. Define the states of matter
6. Read and Interpret the Periodic Table of the Elements
7. Draw, write and understand general structure of atoms
8. Describe and Define the general concepts of the Quantum Theory
9. Solve selected problems using the Gas Laws
10. Demonstrate scientific literacy skills including solving problems using the scientific method
General Chemistry II Online – 100 level
CCC CHEM 152

Course Description:
This course is the second semester of the introduction to the basic laws and principles of general chemistry. It includes acids and bases; liquids, solids, and phase changes; chemical energy, gas laws, and an introduction to organic chemistry. Laboratory exercises are included in this course.

Students must have successfully completed College Algebra (MTH 110) or its equivalent with a “C” or better in the past 5 years. Two years of high school algebra will meet this requirement (with a “C” or better in past 5 years). Students cannot take Chem 151 and Chem 152 concurrently without special permission.

Student Learning Outcomes:
By the end of this course, students should achieve at least 70% proficiency in the following:
1. Solve selected problems using the Gas Laws
2. Predict products of various reaction types and phase changes
3. Describe and Solve selected Redox Reactions
4. Define and Solve selected problems in Combustion
5. Define and Solve selected problems in Chemical Equilibrium
6. Define and Describe concepts in Electrochemistry
7. Define and Solve selected problems in Chemical Energy & Thermodynamics
8. Demonstrate knowledge of the scientific method, metric system and general skills associated with chemistry
9. Describe the basic principles of acid/base chemistry
10. Evaluate and predict the behavior of water and aqueous solutions commonly used in general chemistry
11. Prepare calculations for solutions of specific molarity
Organic Chemistry I – 200 level

Includes:
CNM CHEM 2710

Course Description:
This course is the first of a two-semester sequence of Organic Chemistry, the chemistry of carbon containing compounds, as required for chemistry, medical science, and engineering majors. The course includes theoretical, qualitative, and quantitative discussion of Organic Chemistry concepts, including but not limited to a review of electronic structure and bonding, acids and bases, stereochemistry, an introduction to organic compounds, isomers, substitution and elimination reactions of alkyl halides, reactions of alkenes, alkynes, alcohols, ethers, epoxides, amines, and thiols, mass and infrared spectrometry, ultraviolet/visible spectroscopy, and nuclear magnetic resonance.

Student Learning Outcomes:
1. Review properties of elements and molecules discussed in general chemistry (electronegativity, bonding, formal charge, octet rule).
2. Review chemical reactions discussed in general chemistry (products, reactants, balanced equations, byproducts).
3. Classify organic compounds and their properties by functional group, including substitution and elimination reactions of alkyl halides, reactions of alkenes, alkynes, alcohols, ethers, epoxides, amines, and thiols.
4. Use common and IUPAC rules of nomenclature to name organic compounds.
5. Review the structure and stability of compounds.
6. Comprehend the relationship between structure and reactivity.
7. Comprehend configurations of organic compounds (resonance structures, stereochemistry, isomers).
8. Interpret spectral properties and use in structure determination.
9. Correctly describe the 4-5 step synthesis of a simple organic molecule using reactions learned in the class.
Organic Chemistry I Laboratory – 200 level

Includes:
CNM CHEM 2792

Course Description:
Organic Chemistry I Laboratory is the first-semester laboratory course designed to complement the theory and concepts presented in Organic Chemistry I lecture. The laboratory component will introduce students to techniques for obtaining and analyzing experimental observations pertaining to Organic Chemistry using diverse methods and equipment.

Student Learning Outcomes
1. Appreciate, understand, and conduct experiments safely in the laboratory, being aware of the possible consequences of not adhering to appropriate safety guidelines.
2. Practice and demonstrate skill in the use of molecular drawing and modeling software.
3. Conduct laboratory scale separations to include, but not be limited to distillation, filtration, extraction, recrystallization and chromatography.
4. Conduct characterization experiments using the following techniques: melting points, solubility tests, IR spectroscopy, MS, TLC, and GC.
5. Synthesize, purify, and characterize simple organic compounds.
6. Apply theory and practice in the interpretation of spectroscopic data including, but not limited to FTIR, MS, 1H NMR, 13C NMR and UV/VIS.
7. Assess and account for sources of error in data collection and analysis.
8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
Organic Chemistry II – 200 level

Includes:
   CNM CHEM 2810

Course Description:
This course is the second of a two-semester sequence of Organic Chemistry, the chemistry of carbon-containing compounds, as required for chemistry, medical science, and engineering majors. The course will emphasize structure, main physical properties, chemical reactivity, and reaction mechanisms relating to alcohols, arenes and carbonyl compounds, as well as continued integration of mass and infrared spectrometry, ultraviolet/visible spectroscopy, and nuclear magnetic resonance technique and analysis.

Student Learning Outcomes:
1. Identify functional groups and other key features of different organic compounds.
2. Correctly name organic compounds using the proper nomenclature (IUPAC and common names).
3. Analyze relationships among molecular structure, chemical reactivity, physical and spectral properties.
4. Understand chemical reactivity and reaction mechanisms relating, but not limited to dienes, arenes, alcohols, ethers, amines, phenols, and carbonyl compounds, i.e. aldehydes, ketones, carboxylic acids and derivatives.
5. Write out correctly the mechanisms of electrophilic aromatic substitution, formation and hydrolysis of acetals and ketals, formation and hydrolysis of imines and enamines, conjugate addition of nucleophiles to $\alpha,\beta$-unsaturated carbonyl compounds, Fischer esterification and hydrolysis of esters under both acidic and basic conditions, transesterification under acidic and basic conditions, amide hydrolysis under acidic and basic conditions, the aldol reaction and condensation, and the Claisen condensation/Dieckmann cyclization for examples that are different than those studied in class.
6. Relate structures to spectral properties, interpreting IR, $^{13}$C and $^1$H NMR.
7. Describe the 6-7 step synthesis of a simple organic molecule using reactions learned in this class.
8. Convert the Fischer projection of a carbohydrate to its corresponding Haworth projection, or convert the Haworth projection of a carbohydrate to its Fischer projection.
Organic Chemistry II Laboratory – 200 level

Includes:
   CNM CHEM 2892

Course Description:
Organic Chemistry II Laboratory is the second-semester laboratory course designed to complement the theory and concepts presented in Organic Chemistry II lecture. The laboratory component will introduce students to techniques for obtaining and analyzing experimental observations pertaining to Organic Chemistry using diverse methods and equipment.

Student Learning Outcomes:
1. Appreciate, understand, and conduct experiments safely in the laboratory, being aware of the possible consequences of not adhering to appropriate safety guidelines.
2. Practice and demonstrate skill in the use of molecular drawing and modeling software.
3. Conduct laboratory scale separations to include, but not be limited to distillation, filtration, extraction, recrystallization and chromatography.
4. Conduct characterization experiments using the following techniques: melting points, solubility tests, IR spectroscopy, MS, TLC, and GC.
5. Synthesize, purify, and characterize simple organic compounds.
6. Apply theory and practice in the interpretation of spectroscopic data including, but not limited to FTIR, MS, 1H NMR, 13C NMR and UV/VIS.
7. Assess and account for sources of error in data collection and analysis.
8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
General Chemistry I – 100 level
DACC CHEM 111G

Course Description:
The purpose of this course is to provide a basic understanding of the concepts of chemistry, to provide understanding of the scientific concepts that will help the student to make connection between chemistry, health and the environment, and to teach critical thinking, problem solving, logical reasoning and team work.

Student Learning Outcomes:
By the conclusion of this course, the students should be able to:
1. Demonstrate knowledge of the basic principles of chemistry, including atomic structure, electron configuration, periodic properties, Lewis structure, molecular geometry and hybridization, chemical formulas, reaction types, stoichiometry, solutions and concentrations, and calorimetry.
2. Analyze problems and determine the appropriate mathematical manipulations required to solve problems.
3. Understand the applicability of chemistry to common occurrences in daily life.
General Chemistry II – 100 level  
DACC CHEM 112G

Course Description:  
CHEM 112G is a New Mexico General Education Common Core, Area III Science with Laboratory course. It is a 4 credit hour course guaranteed to transfer and meet general education requirements at any public New Mexico college or university.

Student Learning Outcomes:  
Upon successful completion of General Chemistry II course, students will be able to:  
1. Demonstrate knowledge of the basic chemical principles, including the following areas: Energy changes in chemical reactions, gas laws, intermolecular forces and physical properties of solids and liquids, physical properties of solutions, chemical kinetics, chemical equilibrium, acids and bases, acid-base equilibrium and solubility equilibrium, entropy, free energy, and equilibrium and electrochemistry.  
2. Analyze problems and determine the appropriate mathematical manipulations required to solve problems.  
3. Understand the applicability of chemistry to common occurrences in daily life.
General Chemistry I – 100 level
ENMU CHEM 151

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry I Laboratory – 100 level
ENMU CHEM 151L

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry II – 100 level
ENMU CHEM 152

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry II Laboratory – 100 level
ENMU CHEM 152L

Course Description:
One credit hour. Basic general chemical laboratory techniques. Three hours of lab weekly. Corequisite: CHEM 152

Student Learning Outcomes:
At the end of the semester, the student should be able to
1. Explain the kinetics, mechanisms, and basic rate laws of reactions
2. Describe the factors in chemical equilibria and relate them to environmental conditions
3. Define acids and bases, and the basic reactions of acids and bases
4. Make qualitative and quantitative measurements of acids and bases
5. Discuss properties of transition elements and coordination compounds
6. Explain theories of thermodynamics and the relationships of matter to energy
7. Discuss properties, principles, and applications of redox reactions
8. Demonstrate an understanding of nuclear reactions, radioactive substances, and isotopes
Quantitative Analysis – 200 level
ENMU CHEM 233

Course Description:
Analytical Chemistry is the science of chemical characterization. In this course, you will learn how particular chemical species of interest can be detected and how the amounts of those species can be determined. You will learn how chemical characterization involves chemical reactivity, physical measurement, and data interpretation. All these aspects of chemical characterization will be explored in lecture, reading, and problem solving.

The study of precise and reliable chemical characterization is fundamental to further study and practice in chemistry, biology, medicine, geology, chemical engineering, and many other related fields. The understanding of the methods and limitations of chemical characterization is helpful in making informed judgments on a large variety of social and political issues.

Student Learning Outcomes:
Not provided
Quantitative Analysis Lab – 200 level
ENMU CHEM 233L

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Chemistry for Today – 100 level  
ENMU Ro CHEM 113

Course Description:  
A survey of fundamental chemical concepts and applications for non-science majors. Topics address the application and integration of chemical principles into technology and daily living activities.

Student Learning Outcomes:  
The two main objectives of this course are to improve chemical literacy and provide a general overview of fundamental chemical principles. Instruction is intended to deliver content that explains fundamental principles and develops associated cognitive skills.
1. Introduce the student to the scientific process applied to chemistry.  
2. Effectively use and interpret the periodic table  
3. Effectively use a scientific calculator to for mathematical computations  
4. Become familiar with the metric system and scientific notation  
5. Distinguish between chemical and physical changes  
6. Describe the three main subatomic particles  
7. Effectively use and interpret the periodic table  
8. Identify the characteristics of ionic and covalent bonds  
9. Read and write chemical nomenclature  
10. Balance and do stoichiometry with chemical equations  
11. Comprehend common gas laws  
12. Describe properties of water and solutions  
13. Identify acids and bases and relate them to biological function
CHEMISTRY 121 LAB – 100 level
ENMU Ro CHEM 121L

Course Description:
One credit hour. Lab techniques to accompany CHEM 121. Three hours lab weekly. Corequisite: CHEM 121

Student Learning Outcomes:
Upon completion of this course, the student should be able to:
1. utilize the metric system and scientific notation
2. perform laboratory activities in a safe manner
3. identify and safely use various laboratory equipment
4. safely handle chemicals
5. balance chemical equations
6. perform calculations involving mass, volume, molarity, temperature, density
General Chemistry II – 100 level  
ENMU Ro CHEM 152

Course Description:  
3 credit hours. Basic laws and principles of chemistry. Part II: liquids, solids, solutions, reaction rates and mechanisms, equilibrium, acids and bases, oxidation/reduction, and advanced topics. A continuation of CHEM 151.

Student Learning Outcomes:  
At the end of the semester, the student should be able to:
1. Explain the kinetics, mechanisms, and basic rate laws of reactions  
2. Describe the factors in chemical equilibria and relate them to environmental conditions  
3. Define acids and bases, and the basic reactions of acids and bases  
4. Make qualitative and quantitative measurements of acids and bases  
5. Discuss properties of transition elements and coordination compounds  
6. Explain theories of thermodynamics and the relationships of matter to energy  
7. Discuss properties, principles, and applications of redox reactions  
8. Demonstrate an understanding of nuclear reactions, radioactive substances, and isotopes
Course Description:
Lecture: Basic laws and principles of chemistry part I: Scientific notation, isotopes, atomic and molecular ions, states of matter, Lewis dot structures, periodic chart, ionic compounds, units, significant figures, density, classification of chemical reactions, chemical equations, atomic and molecular weights and molar masses, solutions and concentration, electromagnetic radiation and photons, atomic orbitals, atomic electronic configurations, ionization potentials, electronegativity. Chemical bonds, dipole moments, intermolecular interactions, gases, and an introduction to thermodynamics. Students withdrawing from this course must receive instructor’s permission to retain CHEM 151L. Prerequisite: MATH 119 may be taken concurrently. Co-requisite: CHEM 151L.

Laboratory: Basic general chemical laboratory techniques. Students withdrawing from CHEM 151U may retain this course only with instructor’s permission.

Student Learning Outcomes:
1. Students will explain the periodic table and periodic trends of elements.
2. Students will describe matter in terms of physical and chemical properties.
3. Students will demonstrate an understanding of systems of naming compounds and describe chemical bonding.
4. Students will predict products of chemical reactions and balance chemical equations.
5. Students will explain transformations and movement of energy within reactions.
Introduction to Chemistry I - 100 level
LUNA CHEM 105

Course Description:
Introduction to Chemistry is a review course that includes the fundamental principles in chemistry, including units of measurement, characteristics and behavior, energy, solutions and solubility, redox reactions, theory of gases, chemical bonding, molecular geometry, chemical equilibrium, acid/base chemistry, thermodynamics, and nuclear chemistry.
NM Common Course Number: CHEM1114.

Student Learning Outcomes:
Upon successful completion of this course, with a minimum of 70%=C or better, the student should be able to:
1. Describe the process of scientific inquiry and explain the advances in modern chemistry
2. Solve problems scientifically thorough hypothesis development and lab experiments
3. Communicate scientific information through exams and lab reports
4. Apply quantitative analysis to scientific problems in the laboratory setting
5. Apply scientific thinking to real world problems related to science of chemistry
General Chemistry – 100 level
MCC CHEM 113

Course Description:
This course explores all the realms of basic chemistry. Students will examine and explore such topics as the periodic table, the structure of atoms and molecules, chemical properties, chemical reactions, chemical equations, bonding, chemical equilibrium and scientific laboratory procedures. Laboratory exercises are included.

Student Learning Outcomes:
Successful course completion implies that a student should be able to do the following with at least 70% accuracy:

I. Students of chemistry basics will:
   A. Describe the main features of atoms and molecules.
   B. Explain the Periodic Table.
   C. List methods of measurement in chemistry.

II. Students of the structure of atoms and molecules will:
   A. Describe atomic structure.
   B. Describe molecular structure.

III. Students of chemical reactions will:
   A. Explain the principals of chemical equations.
   B. Describe the main elements of stoichiometry.

IV. Students of gases, light and periodicity will:
   A. Describe the behavior of gases.
   B. Explain the relationship between atoms and light.
   C. Atomic structure and periodicity.

V. Students of bonding and intermolecular forces will:
   A. Outline the fundamentals of bonding.
   B. Describe the nature of multiple bonds.
   C. Explain the structure of macromolecules.
   D. Describe the principal intermolecular forces.

VI. Students of the rates of chemical reactions will:
   A. Describe the principles that govern the rates of reactions.
   B. Explain the main features of experimental kinetics.

VII. Students of chemical equilibria will:
   A. Outline the main features of dynamic equilibrium.
   B. List the types of equilibria.
   C. Explain the principles thermodynamics and equilibrium.
Course Description:
This course is the second of a sequence of two surveying the principles that underlie all chemistry. Topics will include: solutions, chemical kinetics and equilibrium, acidic and basic solutions, electrochemistry, chemical thermodynamics, nuclear chemistry and an introduction to organic chemistry. Laboratory included.

Student Learning Outcomes:
Successful course completion implies that a student should be able to do the following with at least 70% accuracy on instructor exams or projects:

1. Students of properties of gases will:
   a. Describe Pressure, Volume, and Temperature
   b. Explain Boyle’s, Charles’s and Avogadro’s Law
   c. Perform Calculations with The Ideal Gas Law
   d. Perform Calculations of Dalton’s Law of Partial Pressures
   e. Explain the Kinetic Molecular Theory

2. Students of Chemical Thermodynamics will:
   a. Describe Work, Heat, and Energy
   b. Explain Internal Energy and Enthalpy
   c. Calculate the Enthalpy of Formation of Chemical Compounds
   d. Explain and Apply Hess’s Law to Enthalpies of Chemical Reactions

3. Students of Liquids and Solids will:
   a. Describe Properties of Water and its Phase Changes
   b. Calculate Energy Requirements for Changes of State
   c. Describe Types of Intermolecular Forces
   d. Explain Evaporation and the Vapor State
   e. Explain Bonding in Solids and Properties of the Solid state

4. Students of Solutions will:
   a. Explain Solubility
   b. Describe Solution Composition
   c. Perform the Stoichiometry of Solution Reactions
   d. Balance Neutralization Reactions
   Course Syllabus Page 3

5. Students of Chemical Equilibrium will:
   a. Describe the Conditions That Affect Reaction Rates
   b. Explain the Equilibrium Condition
   c. Explain and Calculate the Equilibrium Constant
   d. Describe Heterogeneous Equilibria
   e. Explain and Apply Le Chatelier’s Principle

6. Students of Solutions of Acids and bases will:
   a. Describe Arrhenius Acids and Bases
   b. Describe Bronsted-Lowry Acids and Bases
   c. Explain the pH Scale
   d. Calculate the pH of Strong Acid Solutions
   e. Explain properties of Buffered Solutions
7. Students of Oxidation-Reduction Reactions will:
   a. Explain the Concept of Oxidation States
   b. Describe Oxidation-Reduction Reactions
   c. Balance Oxidation-Reduction Reactions by the Half-Reaction
   d. Method
   e. Describe Properties of Basic Electrochemistry
8. Students of Radioactivity and Nuclear Energy will:
   a. Explain Radioactive Decay
   b. Describe types of Nuclear Transformations
   c. Balance Nuclear Reactions and Perform Half-Life Calculations
   d. Describe Applications of Radioactivity
9. Students of Organic Chemistry will:
   a. Describe the Structure and Nomenclature of Alkanes, Alkenes, Alkynes, and Aromatic Hydrocarbons
   b. Explain and Apply the Fundamental Reactions of Alkanes, Alkenes, Alkynes, and Aromatic Hydrocarbons
   c. Describe the Structure of Functional Groups – Alcohols, Ethers, Aldehydes, Ketones, Carboxylic acids, and Esters
   d. Explain and Apply the Fundamental Reactions of Alcohols, Carboxylic Acids, and Esters.
   e. Describe the Structure of Amines and Amino acids in the formation of Proteins
   f. Describe the Structure and Function of Carbohydrates and Lipids
General Chemistry 2 Recitations/Laboratories – 100 level
NMHU CHEM 216

Course Description:
The recitation will focus on theoretical problem-solving skills, while the laboratory develops practical experimental skills including gas behavior, colligative properties of solutions, calorimetry, chemical kinetics, chemical equilibria, acid/base titrations, electrochemistry, metal reactivity, and qualitative analyses of ions. Co-requisite: CHEM 212.

Student Learning Outcomes:
Not provided
General Chemistry I – 100 level
NMSU A CHEM 111G
NMSU C CHEM 111
NMSU CHEM 111G

Course Description:
This course covers descriptive and theoretical chemistry. Chem 111 and Chem 112 are General Education alternatives to Chem 110G

Student Learning Outcomes:
Upon completion of this course all students will be able to demonstrate an appropriate level of mastery of: The Metric system, Heat, Density, Atomic Theory, Moles and Stoichiometry, Solutions, Chemical Formulas and Equations, Gas Laws, Kinetic Theory, Electronic Structure, Periodic Relationships, Calorimetry and Enthalpy, Bonding, Molecular Structure, Liquid and Solid States.

1. Students will describe the process of scientific inquiry.
   Students should:
   a. Understand that scientists rely on evidence obtained from observations rather than authority, tradition, doctrine, or intuition.
   b. Students should value science as a way to develop reliable knowledge about the world.

2. Students will solve problems scientifically.
   Students should:
   a. Be able to construct and test hypotheses using modern lab equipment (such as microscopes, scales, computer technology) and appropriate quantitative methods.
   b. Be able to evaluate isolated observations about the physical universe and relate them to hierarchically organized explanatory frameworks (theories).

3. Students will communicate scientific information.
   Students should:
   a. Communicate effectively about science (e.g., write lab reports in standard format and explain basic scientific concepts, procedures, and results using written, oral, and graphic presentation techniques).

4. Students will apply quantitative analysis to scientific problems.
   Students should:
   a. Select and perform appropriate quantitative analyses of scientific observations.
   b. Show familiarity with the metric system, use a calculator to perform appropriate mathematical operations, and present results in tables and graphs.

5. Students will apply scientific thinking to real world problems.
   Students should:
   a. Critically evaluate scientific reports or accounts presented in the popular media.
   b. Understand the basic scientific facts related to important contemporary issues (e.g., global warming, stem cell research, cosmology), and ask informed questions about those issues.
Course Description:
Descriptive and theoretical chemistry. Chem 111/Chem 112 are General Education alternatives to Chem 110G.

Student Learning Outcomes:
Upon completion of this course all students will demonstrate an appropriate level of mastery of: Kinetic Theory and Reaction Rates; Dynamic Equilibrium and Equilibrium Concentrations; Acids, Bases, pH and Buffers; Complex Ions; Entropy, Enthalpy and Gibbs Free Energy; Electrochemistry; Nuclear Chemistry and Metallurgy.
Basic Chemistry – 100 level
NMSU CHEM 100

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry I – 100 level
NMSU CHEM 111G

Course Description:
The main goal for Chem. 111G is to equip students with the necessary problem solving skills, vocabulary, and understanding of chemistry to enter and prosper in Chem. 112G or in other science classes at the university level. A second goal is to discover the central importance of chemistry throughout our society and world and to present the wonders of the physical world using an atomic and molecular perspective.

Student Learning Outcomes:
Not provided
Course Description:
This course is a continuation of CHEM 111 and emphasizes the quantitative aspects of chemical behavior. Completion of the two-course sequence fulfills the General Education requirement of the College of Arts and Sciences. To succeed in this course, daily work on practice problems must be done. Exams will test both conceptual understanding as well as quantitative manipulations. Practice will build the required critical thinking and problem solving skills required on the exams.

Student Learning Outcomes:
The student will:
1. describe the process of scientific inquiry
2. solve problems scientifically
3. communicate scientific information
4. apply quantitative analysis to scientific problems
5. apply scientific thinking to real world problems

In CHEM 112, these objectives will be realized by stressing the applications of chemistry to the real world in the areas of solutions, thermodynamics, chemical equilibrium (including acids/bases and solubility) and electrochemistry. This will be achieved through traditional assessments such as homework, quizzes and exams, but will also include opportunities of verbal expression of ideas through written laboratory assignments.
Principles of Chemistry II – 100 level
NMSU CHEM 116

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry III – 200 level
NMSU CHEM 217

Course Description:
This 3 credit hour class completes the general chemistry requirement for chemistry, biochemistry, physics and chemical engineering majors that did not take the CHEM 115/116 sequence. Lab is a co-requisite for this course for all students.

Student Learning Outcomes:
The Higher Education Department has identified several common core competencies which the student will achieve through science courses. The student will:

1. describe the process of scientific inquiry
2. solve problems scientifically
3. communicate scientific information
4. apply quantitative analysis to scientific problems
5. apply scientific thinking to real world problems

In CHEM 217, these objectives will be realized by stressing the applications of chemistry to the real world in the areas of molecular bonding theories, gases and kinetics, thermodynamics and thermochemistry, electrochemistry, and complex acid/base scenarios. If time, polymers will be studied. The objectives will be achieved through traditional assessments such as homework, quizzes and exams, but will also include opportunities of verbal expression of ideas through written laboratory assignments and written integrated problems which have the students brainstorm and integrate the chemistry behind real world phenomenon.
Explorations in Chemistry – 200 level
NMSU CHEM 242

Course Description:
The major intent of this course is to deepen your interest in chemistry and make you aware of research and career opportunities in the field. During this semester we hope to discuss both old and new developments in chemistry that impact our lives. We also want to build our communication skills that are so necessary in our profession.
General Chemistry I – 100 level  
NMSU C CHEM 111

Course Description:  
General Chemistry I is typically a requirement for bachelor degree programs in science, engineering, and pre-professional programs. It can also be used to satisfy the general education laboratory science requirement as a “G” class. We will be using the “Atoms First” approach to chemistry. General Chemistry I is the first semester of a two semester sequence. Please check to see if you will need General Chemistry II—especially if you plan to transfer to a four-year program.

Student Learning Outcomes:  
1. Describe the process of scientific inquiry in chemistry.  
2. Solve problems scientifically using common chemical methods.  
3. Communicate chemical information.  
4. Apply quantitative analysis to chemical problems.  
5. Apply scientific thinking to real world problems.
Course Description:
CHEM 112 is the second half of a two-semester course. It is designed for students who will major in science or a pre-professional program. Emphasis will be placed on introduction to modern theories of chemical bonding and structure of ionic and molecular materials, chemical reactions, states of matter, solutions, thermochemistry, and equilibrium. The laboratory portion will introduce methods and techniques of chemical experimentation, qualitative and semi-quantitative procedures applied to investigative situations and provide students with a background in important concepts and principles in chemistry.

Student Learning Outcomes:
(Based on the NM HED Area III Laboratory Science Competencies)
Upon successful completion of this course students should be able to:
1. Describe the process of scientific inquiry in chemistry.
2. Solve problems scientifically.
3. Communicate chemical information.
4. Apply quantitative analysis to chemical problems.
5. Apply scientific thinking to real world problems.
Special Topics in Chemistry: Nuclear Chemistry Fundamentals – 200 level
NMSU C CHEM 251

Course Description:
CHEM 251 is an introductory, one-semester class intended for non-science majors, pre-nursing majors, and science/engineering majors who may not have had high school chemistry. The intended students could be science majors, science teachers, employees of the nuclear industry, and interested community members. It is not intended to fulfill general education core requirements or to be a required class in a degree program. Students will acquire the basic knowledge upon which to build an understanding and appreciation of chemistry and its relationship to our world and life processes.

Student Learning Outcomes:
Upon successful completion of this course, 95% of the students will be able to:
1. Students will be able to recognize, interpret, and explain fundamental concepts in nuclear chemistry.
2. Students will be able to apply the scientific method to collect, examine and analyze data.
3. Students will employ and critique knowledge of nuclear processes in connection with their own lives.
Course Description:
This course is designed as a survey course for non-science majors. Upon completion of this course, you will have an understanding of the basic concepts of chemistry, with a secondary emphasis on critical thinking and scientific literacy. It is my hope that you will understand more about the world around you through exploration into the topics of chemistry, and that you will enjoy our time together! We will explore how substances interact with each other, and how this impacts our lives on a daily basis. Some topics that will be covered include how measurements are made, properties of household chemicals, water quality, and medical applications. We will also take a brief and introductory foray into organic chemistry.

Student Learning Outcomes:
After Module 1, you should be able to:
1. Identify and explain the individual parts of the scientific method
2. Identify various scenarios as parts of the scientific method
3. Identify the proper number of significant digits in any presented or calculated quantity
4. Properly convert quantities between equivalent units
5. Identify and describe the three states of matter, and their associated phase changes.
6. Differentiate between temperature, energy and heat

After Module 2, you should be able to:
1. Identify the main subatomic particles in an atom
2. Identify the describe the physical structure of an atom.
3. Differentiate between atoms, molecules, and compounds
4. Use the periodic table to:
   a) Identify elements by their name and atomic symbol
   b) Identify and explain trends in atomic properties
   c) Determine the charges of ions
   d) Determine the formulas for and name ionic and molecular compounds
5. Name, explain and describe the major intermolecular forces

After Module 3, you should be able to:
1. Convert between moles and mass of a chemical substance
2. Write balanced chemical equations
3. Determine concentrations of various solutions
4. Perform calculations using concentrations in balanced chemical equations
5. Calculate changes in solution concentrations
6. Determine the solubility of ionic compounds in aqueous solutions
Introduction to Chemistry – 100 level
NMT CHEM 109

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry Laboratory – 100 level
NMT CHEM 122L

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Integrated Organic and Biochemistry – 200 level
NNMC CHEM 210L

Course Description:
Integrated Organic and Biochemistry (CHEM 210): Introductory course designed to meet the entrance requirements in chemistry for students in allied-health fields in which some knowledge of organic chemistry and biochemistry are required. Prerequisite: CHEM 110/L or CHEM 121/L; Co-requisite CHEM 210L. Chemistry of carbon compounds, functional groups, biomolecules, macromolecules, energy and material metabolism. Integrated Organic and Biochemistry Lab (CHEM 210L): this course provides experiences with the physical properties and laboratory synthesis of organic compounds. Includes exercises in the preparation, separation, isolation and characterization of biologically derived molecules. Co-requisite: CHEM 210.

Student Learning Outcomes:
Course content upon which a student’s level of mastery will be assessed includes the capability to...
1. Discuss the chemical, structural, and physical differences among the different functional groups
2. Prepare, label, and use solutions of appropriate and known concentrations
3. Recognize chiral organic molecules, and explain their biological significance.
4. Understand and be able to identify the process of organic reactions: nucleophilic and electrophilic, redox reactions, and enzyme catalyzed reactions.
5. Predict the products of substitution, elimination, condensation, and redox reactions.
6. Explain why certain lipids and amino acids are essential while others are not.
Quantitative and Analytical Chemistry – 200 level
NNMC CHEM 221

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Quantitative and Analytical Chemistry Lab – 200 level
NNMC CHEM 221L

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Standard Laboratory Protocols – 200 level
NNMC CHEM 260

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Undergraduate Research Experience I – 200 level
NNMC CHEM 290

Course Description:
Not provided

Student Learning Outcomes:
Not provided
Elements of Chemistry – 100 level
NTU CHM 110

Course Description:
Not provided

Student Learning Outcomes:
Not provided
General Chemistry 1 with laboratory – 100 level
NTU CHM 120

Course Description:
This course introduces students to chemistry measurements, atomic structure, chemical
reactions, stoichiometry, thermochemistry, quantum chemistry, periodic properties, atomic and electronic
structures of atoms, and bonding.

Student Learning Outcomes:
1. Use the scientific method to carry out an experiment
2. Understand and perform measurements used in chemistry
3. Analyze chemical reactions and predict products
4. Study the energies involved in chemical reactions
5. Examine atomic structure
6. Explore the periodic table, electron activities, and reactivity of elements.
Environmental Chemistry – 200 level
NTU CHM 254

Course Description:
This course introduces students with a topics-based approach to chemistry of the environment. They are expected to have some knowledge of chemistry, with a desire of applying this knowledge to the environment. Topics of interest include environmental of water, water pollution, water treatment, geochemistry, atmospheric chemistry, air pollution, radioactivity, hazardous materials and resources.

Student Learning Outcomes:
The students will be able to discuss the:
1. A strong understanding of environmental issues in Navajo Nation, state, federal, and global issues.
2. The present concepts and application into the environment.
3. The basic theories and methods of environmental chemistry.
4. Be able to describe and understand environmental threats to air, water, soil, ozone depletion, groundwater pollution, and agricultural impact to water and soil.
Integrated Organic & Biochemistry I Lab – 200 level
SFCC CHEM 212L

Course Description:
Hands-on lab to supplement the lecture material; covers hydrocarbons, alcohols, aldehydes & ketones, carboxylic acids, carbohydrates, proteins and enzymes.

Student Learning Outcomes:
At the conclusion of this course, students will be able to:
1. Understand the nature of organic molecules, including how to build them and recognize their structures.
2. Recognize the reactions and functions of selected organic compounds.
3. Understand the nature, reactions and classification of carbohydrates.
4. Relate the learned lab techniques to real life examples by on a lab research project.
ORGANIC CHEMISTRY I – 200 level
SJC CHEM 251

Course Description:
Part one of the study of carbon compound chemistry covering: atomic and molecular orbitals; structure and reaction mechanisms of alkanes, alkenes, and alcohols; laboratory synthesis; gas chromatography; infrared, mass, and nuclear magnetic resonance spectroscopies. For pre-professional majors.

Student Learning Outcomes:
Upon successful completion of the course, the student will be able to...

1.1 Draw resonance structures and use them to predict stabilities of radicals and ions.
1.2 Identify nucleophiles and electrophiles, and predict Lewis acid-base reactions.
1.3 Predict hybridization and geometry of atoms in molecules.
1.4 Describe sigma and pi bonding in terms of orbital overlap.
1.5 Identify structural isomers and stereoisomers.
1.6 Predict boiling and melting points based on structure.
1.7 Predict acid-base behavior based on structure.
2.1 Name and draw alkanes.
2.2 Compare the energies of alkane conformations and predict the most stable conformations.
2.3 Explain the mechanism and energetics of the free-radical halogenation of alkanes.
2.4 Predict the products of the halogenation of an alkane.
3.1 Identify chiral centers and mirror planes of symmetry.
3.2 Define optical activity.
3.3 Use R and S nomenclature.
3.4 Draw Fisher projections and use them in identifying stereochemical properties.
3.5 Identify and classify diastereomers, enantiomers, meso compounds, and geometric isomers.
4.1 Predict the products of SN1, SN2, E1, and E2 reactions including stereochemistry.
4.2 Draw the mechanisms of SN1, SN2, E1, and E2 reactions including stereochemistry.
5.1 Name alkenes.
5.2 Predict relative stabilities of alkenes and cycloalkenes based on structure and stereochemistry.
5.3 Propose logical mechanisms for dehydrohalogenation, dehalogenation, and dehydration reactions.
5.4 Predict the products of additions, oxidations, reductions, and cleavages of alkenes, including regiochemistry and stereochemistry.
5.5 Use alkenes in devising single step and multistep synthesis.
6.1 Name alkynes.
6.2 Show the reaction and mechanism of how an alkyne is synthesized.
6.3 Identify an acetylenic hydrogen and discuss the unique chemistry of this hydrogen.
6.4 Predict the products of additions, oxidations, reductions, and cleavages of alkynes, including regiochemistry and stereochemistry.
6.5 Use alkynes in devising single step and multistep synthesis.
7.1 Show how to convert alkenes, alkyl halides, and carbonyl compounds to alcohols.
7.2 Predict alcohol products of hydration, hydroboration, and hydroxylation of alkenes.
7.3 Use retrosynthetic analysis to propose effective syntheses of compounds using alcohols.
8.1 Synthesize and investigate reactions of alkyl halides, alkenes, and alcohols in the laboratory.
8.2 Apply chemical and physical tests to identify organic compounds.
8.3 Identify key components and principles of operation of a gas chromatograph.
8.4 Use gas chromatography to separate and identify components of a mixture.
8.5 Describe how an infrared spectrophotometer works.
8.6 Given an IR spectrum, identify functional groups.
8.7 Describe how a mass spectrometer works.
8.8 Use the fragmentation pattern of a mass spectrum to determine structure.
8.9 Describe how a nuclear magnetic resonance spectrometer works.
8.10 Combine the chemical shifts, intervals, and spin-spin splitting patterns in the NMR spectrum with information from IR and MS to determine the structures of organic compounds.
ORGANIC CHEMISTRY II – 200 level
SJC CHEM 252

Course Description:
Part two of the study of carbon compound chemistry covering: structure and reaction mechanisms of carboxyl, amine, conjugated, and polyfunctional systems; ultraviolet spectroscopy; biochemistry; and synthetic polymers.

Student Learning Outcomes:
Upon successful completion of the course, the student will be able to...

1. Propose Williamson ether synthesis of ethers.
2. Show the mechanisms of acid catalyzed and base catalyzed ring opening of epoxides.
3. Show the mechanism of epoxidation and acid catalyzed ring opening and cyclization related to the biosynthesis of steroids.
4. Show the mechanism of the formation of epoxy ether based polymers.
5. Construct molecular orbitals and electronic configurations of conjugated systems.
6. Predict the products of Diels-Alder reactions.
7. Use HOMO-LUMO interactions to predict thermal or photochemical cycloadditions.
8. Predict UV absorption maxima of conjugated systems.
10. Use the polygon rule on conjugated cyclic systems to determine aromaticity.
11. Determine the aromaticity of heterocyclic compounds and nitrogen acidity.
12. Use IR, NMR, UV, and MS to determine the structures of aromatic compounds.
13. Predict products and give mechanisms for electrophilic aromatic substitutions.
14. Design syntheses that use the influences of substituents to generate the correct isomers of multisubstituted aromatic compounds.
15. Explain how Friedel-Crafts Acylation overcomes two of the three limitations of Friedel-Crafts Alkylation.
16. Show how to synthesize ketones and aldehydes from oxidation of alcohols, ozonolysis, Friedel-Crafts acylations, organolithiums, and acid chlorides.
17. Show mechanisms of nucleophilic additions and condensation reactions.
18. Interpret the IR, NMR, UV, and MS of ketones and aldehydes.
20. Predict the approximate maxima for allowed and forbidden electronic transitions.
21. Show how to synthesize amines by reductive amination and acylation-reduction.
22. Predict the basicity of amines.
23. Use amines in synthesis.
24. Interpret the IR, NMR, UV, and MS of amines.
25. Name and identify acids, acid chlorides, anhydrides, amides, esters, carbonates, and urethanes.
26. Use carboxylic acids and derivatives in fisher esterification and hydrolysis reactions.
27. Show how to interconvert acid derivatives by Nucleophillic Acyl Substitution.
28. Interpret the IR, NMR, UV, and MS of carboxylic acids.
29. Identify and name essential features of carbohydrates and nucleic acids.
30. Determine the structures of the anomers and epimers of glucose.
31. Name monosaccharides and disaccharides, and draw their structures from their names.
32. Predict reaction products and write mechanisms involving carbohydrates.
33. Recognize the structures of DNA and RNA, and draw the structures of a ribonucleotide and deoxyribonucleotide.
34. Name amino acids and peptides, and draw the structures from their names
35. Explain which amino acids are acidic, basic, or neutral.
36. Show how an amino acid is synthesized.
37. Show how classical and solid-phase peptide synthesis would be used to make a given peptide.
38. Discuss and identify the four levels of protein structure.
40. Predict physical properties of fats and oils.
41. Identify isoprene units in terpenes.
42. Explain how soaps and detergents work.
43. Synthesize and analyze, ethers, aromatics, carbonyls, and amines in the laboratory.
ANALYTICAL CHEMISTRY – 200 level
SJC CHEM 281

Course Description:
Fundamentals of instrumental chemical analysis. Topics include: statistical methods, digital control and data acquisition, gas/liquid chromatography, emission/absorption spectroscopy, capillary electrophoresis, volumetric, gravimetric, and electrochemical analysis. For chemistry and some pre-professional majors.

Student Learning Outcomes:
Upon successful completion of the course, the student will be able to...
1. Prepare solutions of desired molarity.
2. Interconvert between molarity, weight percent, parts per million, and parts per billion.
3. Perform equilibrium constant calculations, manipulations, and apply towards Le Chatelier’s principle.
4. Use the buoyancy equation and correct for buoyancy.
5. Correctly use volumetric glassware such as burets, flasks, and pipets.
6. Calibrate volumetric glassware.
7. Describe and perform filtration, and drying procedures.
8. Describe and perform dissolution, fusion, digestion, and extraction sample prep procedures.
9. Use correct significant figures in calculations.
10. Describe and distinguish systematic and random errors.
11. Compute absolute and relative uncertainty.
12. Propagate errors in calculations.
13. Properly set up, annotate, and use spreadsheets.
14. Use spreadsheets for graphing.
15. Calculate mean, standard deviation, and relative standard deviation.
16. Compute and use the F test to determine if two sets of measurements are statistically different.
17. Use student’s t to compute the confidence interval of replicate measurements.
18. Compare means with student’s t test to determine if they are statistically different.
19. Set up a spreadsheet for the t test.
20. Use Grubbs test for determining outliers.
21. Construct a calibration curve including error bars using a spreadsheet.
22. Set up a spreadsheet to compute slope and intercept with errors using least squares analysis.
23. Outline quality assurance procedures and methods.
24. Perform analysis by standard addition.
25. Set up and use a spreadsheet for standard addition.
26. Perform analysis using internal standards.
27. Perform a back titration.
28. Perform a blank titration.
29. Perform a direct titration.
30. Perform a standardization.
31. Perform Volhard and Fajans argentometric titrations.
32. Perform gravimetric analysis.
33. Calculate pH and concentrations involved in acid base equilibria.
34. Prepare buffer solutions.
35. Use pH electrode and spreadsheet to find the endpoint numerically in an acid base titration.
36. Perform a Kjeldahl nitrogen analysis.
37. Compute ionic strength of solutions.
38. Compute activity coefficients.
40. Perform an EDTA titration.
41. Analyze and diagram an electrochemical cell.
42. Compute electrode and cell potentials.
43. Describe and use reference electrodes.
44. Describe how a AgCl electrode works.
45. Describe how a calomel electrode works.
46. Interconvert potentials between different reference electrodes.
47. Describe and use a silver indicator electrode.
48. Describe and use ion selective electrodes.
49. Describe and use pH electrodes.
50. Describe and use amperometry and voltammetry techniques.
51. Perform cyclic voltammetry in chemical analysis.
52. Describe and calculate properties and quantities involving light.
53. Use Beer’s law.
54. Describe single and double beam spectrophotometers.
55. Describe photo-detection schemes including diode array and photo-multiplier-tubes.
56. Describe fluorescence and phosphorescence physical processes.
57. Describe absorbance and luminescence instrumentation.
58. Describe processes and components of an atomic absorption spectrophotometer.
59. Describe processes and components of an inductively coupled plasma spectrophotometer.
60. Perform analysis using an inductively coupled plasma spectrophotometer.
61. Describe gas/liquid chromatographic theory, equipment, and techniques.
62. Describe capillary electrophoresis theory, equipment, and techniques.
63. Calculate theoretical plates and resolution of columns.
64. Describe band dynamics.
Preparation for College Chemistry – 100 level
UNM CHEM 115
UNMV CHEM 115

Course Description:
A preparatory course for students who feel they are not prepared or who do not have the pre-requisite requirements for Chemistry 121/123L. A grade of "CR" can be used as placement into CHEM 121/123L. This course cannot be used for science credits.

Student Learning Outcomes:
Students will be able to
1. Apply mathematical knowledge of college algebra, graphing, exponential, and logarithm in chemistry word problems;
2. Handle significant figures for addition, subtraction, multiplication, and division;
3. Carry out simple unit conversions;
4. Use periodic table;
5. Balance simple chemical equations
6. Solve fundamental stoichiometric problems of chemical formula and reactions
7. Do calculations involving moles, molarity, weight percent
8. Understand and explain the relationship between pH and acidity
Foundations of Chemistry – 100 level
UNM CHEM 120
UNMV CHEM 120

Course Description:
Chemistry 120 is a unique preparatory 3 credit course for Chemistry 121 and your subsequent chemistry courses. It has a dual purpose; firstly, to help you obtain a solid foundation in the chemical concepts that are essential to your future Chemistry and Science classes, and secondly to optimize your set of learning skills to help you learn more efficiently, demonstrate your knowledge and succeed in your future fast-paced high level science courses. The course consists of three 50-minute class sessions for MWF or two 75 minute class sessions for TR each week in which basic chemical concepts will be learned in a small-group problem-solving format.

Student Learning Outcomes:
1. Express uncertainty in measurements using appropriate significant figures. Determine the appropriate significant figures to express the result of any series of calculations involving simple arithmetic operations.
2. Use dimensional analysis to solve multi-step unit conversion problems.
3. Use the concept of density in qualitative and quantitative problems.
4. Describe the structure of the atom in terms of location, charge and relative size of subatomic particles. Use atomic notation for atoms and their isotopes and ions.
5. Determine average atomic mass of an element and use the mole concept to determine the number of atoms or moles in a particular mass.
6. Use the periodic table to predict the nature of bonding between two elements and name the resulting compound based on IUPAC convention.
7. Use the mole concept to relate numbers of molecules to moles and masses.
8. Classify matter by state and composition. Distinguish between physical & chemical properties & states.
9. Write and balance equations to describe chemical reactions.
10. Relate quantities of reactants and products in chemical equations in stoichiometric calculations.
UNM CHEM 123/124 General Chemistry Laboratory – 100 level

Course Description:
This course is the laboratory course of general chemistry for majors. Students must take this course with the general chemistry lecture course (CHEM 121 or 131 for the first semester or CHEM 122 or 132 for the second semester). This course is also a UNM core course. In order to obtain the credit for UNM core, you must register for letter grade and earn a C or better (C- will not be credited).

Student Learning Outcomes:
123L Students will be able to
1. Dress properly for laboratory work and wear safety goggles for eye protection
2. Handle chemicals safely and properly, which include transfer and disposal of chemicals
3. Prepare solutions with an acceptable accuracy to a known concentration using volumetric flask
4. Properly prepare scientific graphs to demonstrate quantitative relationships between variables
5. Demonstrate mastery in experimental techniques for pressure measurements, calorimetric measurements, and spectrophotometric measurements.
6. Write and revise simple hypotheses based on selected chemical principles and or observations
7. Design experimental procedure for simple lab questions
8. Properly use lab notebook to record experimental data and observations with correct significant figures and units
9. Make meaningful analysis of experimental data and summarize the results in a proper format
10. Communicate scientific arguments effectively and logically in a written and an oral form.
Course Description:
As the first of a two-semester sequence, this course teaches fundamental concepts in chemistry, including the electronic structure of atoms, chemical periodicity, nature of chemical bonds, molecular structure, the three phases of matter, etc. In addition, the application of these concepts to various chemical sub-disciplines, such as organic chemistry, biochemistry, and materials chemistry. Designed for majors in chemical sciences and engineering, it is assumed that the students are familiar with college algebra, chemical nomenclature, stoichiometry, and scientific measurements.

Student Learning Outcomes:
1. Apply the mole concept to amounts at a microscopic level and use this to perform stoichiometric calculations for reactions in solution, gases and thermochemistry.
2. Calculate solution concentrations in various units.
3. Apply the gas laws and kinetic molecular theory to relate atomic level behavior to macroscopic properties.
4. Explain the electronic structure of atoms, isotopes and ions in terms of its subatomic particles.
5. Analyze how periodic properties (e.g. electronegativity, atomic and ionic radii, ionization energy, electron affinity, metallic character) and reactivity of elements results from electronic configurations of atoms.
6. Understand the nature of chemical bonds (ionic and covalent). Apply knowledge of electronic structure to determine molecular structure and polarity.
7. Understand the formation of different phases of matter and the underlying fundamental intermolecular interactions.
8. Describe physical states and changes, and distinguish these from chemical changes.
9. Describe the energy conversions that occur in chemical reactions and state changes, relating heat of reaction to thermodynamic properties such as enthalpy and internal energy; apply these principles to measure and calculate energy changes in reaction.
10. Apply principles of general chemistry to specific real-world problems in environment, engineering and health-related fields.
Principles of Chemistry II – 100 level
UNM CHEM 132

Course Description:
As the second of a two-semester sequence, this course teaches fundamental concepts in chemistry, including solutions, equilibria, electrochemistry, thermodynamics and kinetics. Designed for majors in chemical sciences and engineering, it is assumed that the students are familiar with college algebra, chemical nomenclature, stoichiometry, and scientific measurements.

Student Learning Outcomes:
1. Describe the colligative properties of solutions and explain them using intermolecular forces. Determine solution concentrations using colligative property values and vice versa.
2. Explain rates of reactions, rate laws, and half-life; determine the rate, rate law and rate constant of a reaction and calculate concentration as a function of time and vice versa. Understand the principle of catalysis.
3. Explain the collision model of reaction dynamics, including activation energy, catalysts and temperature; Derive a rate law from a reaction mechanism and evaluate the consistency of a mechanism with a given rate law.
4. Describe the dynamic nature of chemical equilibrium and its relation to reaction rates; apply Le Chatelier’s Principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures.
5. Describe the equilibrium constant and use it to determine whether equilibrium has been established; calculate equilibrium constants from equilibrium concentrations (including pressures) and vice versa.
6. Describe the different models of acids and base behavior, and the molecular basis for acid strength.
7. Apply equilibrium principles to aqueous solutions, including acid-base and solubility reactions; calculate pH and species concentrations in buffered and unbuffered solutions.
8. Explain titration curves and speciation diagrams; calculate concentrations of reactants from the former and determine dominant species as a function of pH from the latter.
9. Explain and calculate the thermodynamic functions enthalpy, entropy and Gibbs free energy for a chemical system; relate these to equilibrium constants and reaction spontaneity.
10. Balance redox equations, express them as two half reactions and evaluate the potential, free energy and equilibrium K for the reaction, as well as predict the spontaneous direction.
11. Construct a galvanic or electrolytic cell; determine the standard (and non-standard) cell potential of the former and relate current to electron transfer rates in the latter.
12. Understand the basic chemical properties of main group and transition metal elements and develop a broad understanding of several key branches of chemistry.

General Chemistry II – 100 level
UNM G CHEM 122

Course Description:
Not provided

Student Learning Outcomes:
The students should be able to:
A1. Demonstrate that they attained enough chemistry background so that they can take higher level of chemistry and other science courses to pursue science careers.

A2. Use their knowledge of chemistry in their daily lives to make knowledgeable decisions regarding the environment and health related issues.

B1. Demonstrate an enthusiasm for learning chemistry and applying that knowledge to connect chemistry with their major field of study.

C1. Do mathematical computations in chemistry problems by using scientific method and critical thinking.

C2. Demonstrate that they have acquired enough mathematical skills to solve chemistry word-problems using dimensional analysis and be able to express their numerical answers in scientific notation with correct number of significant figures and correct units.

D1. Make a connection between various concepts of chemistry with daily life phenomena in biological and other fields of sciences and use that knowledge to make intelligent decisions related with the environment and health issues.

D2. Describe valence bond and molecular orbital theory.

D3. Explain the intermolecular forces of attraction, qualitatively evaluate those forces from structure and correlate those to the corresponding physical properties, and understand phase transitions.

D4. Calculate concentration of solutions using different units and convert from one concentration units to another, describe the colligative properties of solutions.

D5. Explain rates of reaction, rate laws, and half-life, determine the rate as well as rate law (differential and integrated) of a reaction, use rate law to calculate half-life, explain the collision model of a reaction, derive the rate law using reaction mechanism and evaluate the proposed reaction mechanism using a given rate law.

D6. Describe the dynamics of chemical equilibrium and describe and apply Le Châtelier principle to predict the effect of change in concentration, pressure, and temperature on the position of an equilibrium, as well as describe the equilibrium constant and calculate its magnitude using equilibrium concentrations and use the magnitude to determine whether equilibrium has been established.

D7. Describe various definitions of acids and bases and the molecular basis for acid strength, apply equilibrium principles to aqueous solutions, including acid-base reactions, solubility equilibria and calculate pH and concentrations of species in a solution including both unbuffered and buffer solutions, and also describe the acid-base properties of salts and solubility of insoluble salts as well as how solubility of salts is used to do qualitative analysis of cations and correlate solubility to complex ion formation.

D8. Describe the effect of common ions on the ionization of weak acid or weak base, explain titration curves and speciation diagrams, and use them to determine dominant species and to calculate pH.

D9. Explain and calculate thermodynamic functions such as enthalpy, entropy, and free energy, for a chemical reaction and correlate them to equilibrium constant and reaction spontaneity.

D10. Balance redox reactions using half-reaction method, construct a theoretical model of both a galvanic cell as well as an electrolytic cell, evaluate the cell potential to calculate the free energy of a redox reaction.

D11. Describe the formation of coordination compounds of first-row transition metals, common ligands and explain how they bind to transition metals, as well as be familiar with coordination number of the transition metals, and isomerism associated with coordination compounds, explain formation of complex ions of transition metals using Localized Electron Model as well as the Crystal Field Model, and describe the biological importance of Coordination complexes.

D12. Describe and balance a nuclear reaction (nuclear fusion and nuclear fission), calculate the half-life of a radioactive material, and also describe how radioactivity is detected and its applications in our daily lives.
E1. Students should have acquired necessary background in chemistry to carry out a variety of chemistry lab experiments based on theoretical concepts presented in the lecture course.
Quantitative Analysis Lecture and Laboratory – 200 level

Includes:
   UNM CHEM 253L

Course Description:
Quantitative Analysis is a sub-discipline within analytical chemistry which deals with the identification and assay of a material or its components. Students will learn how chemical characterization involves chemical reactivity, physical measurement, and data interpretation with an emphasis on solution equilibria and electrochemistry. The study of precise and reliable chemical characterization is fundamental to further study and practice in chemistry, biology, medicine, geology, chemical engineering, and many other related fields. The understanding of the methods and limitations of chemical characterization can aid in making informed judgments on a large variety of social and political issues. This course is designed to introduce you to techniques of Quantitative Analysis and complement the theory and concepts presented in lecture. Students will obtain reproducible quantitative laboratory data using classical (volumetric, gravimetric) and simple instrumental (potentiometric, spectrophotometric, chromatographic) methods, as well as analyze and interpret laboratory data using standard statistical and validation approaches.

Lecture Student Learning Outcomes:
1. Gain fundamental understanding of the principles and methodologies of Quantitative Analysis.
2. Understand how random measurement errors lead to the Gaussian distribution, and how to use this distribution for probability calculations.
3. Use and interpret statistical tests like the T-test, F-test, Grubbs test and linear regression.
4. Understand the basis of equilibrium treatment for aqueous reactions—proton transfer, electron transfer, solubility, metal complexation.
5. Predict (calculate) equilibrium speciation in complex systems, accounting for multiple reactions and ionic activities.
6. Understand the physical/chemical basis for common classical (volumetric, gravimetric) and instrumental (potentiometric, spectrophotometric, chromatographic, mass spectrometric) methods.
7. Recognize interferences in chemical and instrumental analysis.
8. Comprehend and analyze applications of Quantitative Analysis to everyday social and political issues.

Lab Student Learning Outcomes:
1. Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis.
2. Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology.
3. Comprehend concept of and perform calibration of measurement instruments.
4. Demonstrate knowledge of sampling methods for states of matter.
5. Use statistical and validation methods for evaluating and interpreting data.
6. Assess and account for sources of error in data collection and analysis.
7. Appreciate, understand, and practice concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
8. Present experimental results in laboratory reports of appropriate length, style and depth, or through other modes as required.
Course Description:
Not provided

Student Learning Outcomes:
The students should be able to:

A1. Demonstrate that they attained enough hands-on experience in chemistry experiments so that they can take higher level of chemistry and other science courses to pursue science careers.
A2. Demonstrate and apply concepts associated with laboratory safety, including the possible consequences of not adhering to appropriate safety guidelines.
A3. Demonstrate the computational skills needed to perform appropriate laboratory-related calculations to include but not be limited to determining the number of significant figures in numerical value with the correct units, solving problems using values represented in exponential notation, solving dimensional analysis problems and manipulate mathematical formulas as needed to determine the value of a variable.
A4. Perform laboratory observations (both qualitative and quantitative) using sensory experience and appropriate measurement instrumentation (both analog and digital).
A5. Perform basic laboratory experiments related to, but not limited to, colligative properties of solutions, chemical kinetics, chemical equilibria, titrations (acid/base and redox), and quantitative determinations of metal ions.
A6. Draw appropriate conclusions based on analysis of the data collected during laboratory experimentation.
A7. Present experimental results as laboratory reports of appropriate length, style and depth, or through other modes as required.
A8. Figure out the molecular geometry of species based on Lewis structures.
A9. Name and write formulas of coordination compounds of transition metals.
A10. Correlate experimental observations, operations, calculations and findings to theoretical concepts presented in the complementary lecture course.
B1. Carry out various chemistry laboratory experiments based on what they have learned in lecture course such as preparing a solution of known concentration with acceptable accuracy using appropriate glassware.
Elements of General Chemistry – 100 level
UNM LA CHEM 111

Course Description:
This class will be structured as a studio class which differs from a “normal” lecture classroom. Each class will be a mixture of mini-lectures, group work, individual computer work using ALEKS, demos, short lab exercises, student presentations, quizzes, and tests. We, of course, won’t do all of those each class, but we will participate in some subset each class. Normally there is a separate lab with this course at UNMLA, but it will be integrated into the class and all lab exercises and demos will occur as we reach the material in the text. ALEKS is an online learning system that is mastery based. This means that it requires a student to master content before they can proceed. There will be due dates for your ALEKS work, and working on ALEKS will be the majority of your homework. While you are working on ALEKS in class, the instructor and peer helpers will be available to answer questions. You should plan on spending time outside of class to complete your ALEKS work.

Student Learning Outcomes:
At the end of the course students will be able to:
1. Describe the process of scientific inquiry. (HED Competency #1)
   a. Apply the scientific method to a chemical problem.
   b. Identify bonding electrons, nonbonding electrons, single bonds, double bonds, and triple bonds in an electron dot structure.
   c. Translate chemical equations into a statement and vice versa.
   d. Classify basic reaction types.
   e. Identify spectator ions and write a net ionic equation.
   f. Predict the molecular formulas of all potential products in simple chemical reactions.
   g. Describe major historical changes in scientific perspectives on atomic theory, tectonics
   h. Know that science plays a role in many different kinds of careers and activities.
2. Students will solve problems scientifically. (HED Competency #2)
   a. Classify elements as metals, metalloids, or non-metals based on their position in the periodic table or based on their physical properties and identify whether a specified element is a solid, liquid, or gas at STP.
   b. Explain how periodic behavior of elements results from electron configurations of atoms.
   c. Distinguish between chemical and physical transformations.
   d. Identify important questions that science cannot answer.
   e. Observe the effects of a chemical reaction.
   f. Graph and interpret measured data.
3. Students will communicate scientific information. (HED Competency #3)
   a. Describe the Basic Structure of the Atom in terms of its subatomic particles
   b. Describe basic properties of protons, neutrons, and electrons
   c. Understand how elements are organized in the periodic table and locate groups 1, 2, 17, and 18 by name and group number.
   d. Recall element names from symbols and vice versa for common elements.
   e. Perform stoichiometric calculations and make use of the mole concept.
   f. Determine the limiting reagent and theoretical yield in a chemical reaction.
   g. Balance chemical equations.
   h. Define basic physical quantities include mass, volume, energy, temperature, and density.
   i. Identify elements, compounds, and mixtures.
j. Describe the differences between ionic bonding and covalent bonding and classify compounds as ionic or covalent (molecular).
k. Describe the three most common phases of matter on a molecular level.
l. Define the various types of common intermolecular interactions and apply this knowledge to molecules.
m. Understand what acids and bases are and how our view of them has evolved.
n. Understanding activation energy and catalysts.
o. Understand electrolytes and batteries.
p. Understanding molarity and applying it to solution problems.

4. Students will apply quantitative analysis to scientific problems. (HED Competency #4)
a. Use atomic notation, estimate the dominant isotope of an element when given the masses of the two most abundant isotopes and the observed atomic mass.
b. Perform unit conversions within the SI system.
c. Predict compound formulae using the octet rule.
d. Identify and define polar and non-polar bonds.
e. Predict the relative polarity of a bond using general trends in electronegativity along with the periodic table.
f. Predict bond and molecular polarity.
g. Draw electron dot structures for a molecule.
h. Line spectra, atomic theory, and the electromagnetic spectrum.
i. Apply significant figures and scientific notation to numerical problems.
j. Know the difference between precision and accuracy.
k. Ideal gas law and how to apply it.
l. Calculate [H+], pH, [OH⁻], and pOH values for aqueous solutions and evaluate the acidity/alkalinity of a solution.
m. Distinguish between strong acids and weak acids qualitatively and quantitatively.
n. Draw and interpret reaction energy diagrams.
o. Write a rate law derived from a mechanism.
p. Construct equilibrium constant expressions.
q. Evaluate equilibrium constants qualitatively and quantitatively.
r. Determine the oxidation states using the short cut rules.
s. Determining reaction order and effects of concentration on rate.
t. Be able to numerically solve a titration problem.
u. Use a burette to perform a titration.
v. Perform mathematical analysis of results.
w. Calculate and evaluate the error in measured data.

5. Students will apply scientific thinking to real world problems. (HED Competency #5)
a. Students will understand basic radioactivity decay modes and the half-life of a radioactive isotope.
b. Predict relative melting and boiling points based upon the analysis of the intermolecular forces present.
c. Predict how a system will be affected by various concentrations, pressure, and temperature changes using Le Chatelier’s Principle.
d. Determine formulas from combustion analysis data.
e. Determining the percent composition of an element in a molecule.
f. Predict whether or not a precipitate will form using a solubility table.
g. Predict how reaction rate varies with pressure, concentration, and temperature.
h. Predict the shape and bond angles using the VSEPR model.
i. Predict how bond angles are affected by electronic and steric interactions.

j. Identify common acids and bases and list where some are commonly encountered in daily life.

k. Naming chemical compounds: writing the name from a formula and writing the formula given the name (ionic, molecules, and acids)

l. Recognize redox reactions.

m. Applying the EMF series to real world problems (i.e. corrosion).

n. Understand and solve problems involving finding the total energy needed/lost to raise/lower the temperature of a compound through multiple phase changes. Be able to draw and interpret a graph that depicts this change.

o. Explain how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and composition of stars.

p. Explain how objects in the universe emit different electromagnetic radiation and how this information is used.

q. Describe how stars are powered by nuclear fusion, how luminosity and temperature indicate their age, and how stellar processes create heavier and stable elements that are found throughout the universe.

r. Describe uses of radioactivity.

s. Be able to quantitatively solve a bomb calorimetry problem.

t. Know how to perform a dilution or create a solution of a specific molarity or percent concentration.

u. Measure and transfer liquids using a beaker, graduated cylinder, volumetric flask, and pipette.

v. Determine the mass of a substance on a balance.

w. Differentiate between how solids and liquids are handled in a lab setting.
Introduction to Chemistry – 100 level
UNM T CHEM 111

Course Description:
This is a one-semester survey of general chemistry principles for allied health science majors. The course is required for students majoring in pre-nursing, pre-dental hygiene and other health sciences areas except pre-medicine and medical technology. It is not intended as a preparatory course for Chem 121. NOTE: UNM will NOT grant course credit for BOTH Chem 111 and Chem 121. Proficiency in the material covered in MATH 121 such as manipulating roots, radicals and exponents, solving equations, solving systems of equations, logarithms and word problems is required for this course and it will be assumed that the student is proficient.

Student Learning Outcomes:
By the end of the semester, students will be able to:
1. Describe the basic structure of the atom in terms of its subatomic particles.
2. Describe basic properties of protons, neutrons and electrons.
3. Use atomic notation, estimate the dominant isotope of an element when given the masses of the two most abundant isotopes and the observed atomic mass.
4. Understand how elements are organized in the periodic table and locate groups 1, 2, 17 and 18 by name and group number.
5. Recall element names from symbols and vice versa for common elements.
6. Classify elements as metals, metalloids or non-metals based on their position in the periodic table or based on their physical properties and identify whether a specified element is a solid, liquid or gas at STP.
7. Explain how periodic behavior of elements results from electron configurations of atoms.
8. Define basic physical quantities including mass, volume, energy, temperature and density.
9. Perform unit conversions within the SI system.
10. Distinguish between chemical and physical transformations.
11. Identify elements, compounds and mixtures.
12. Perform stoichiometric calculations and make use of the mole concept.
13. Determine the limiting reagent and theoretical yield in a chemical reaction.
15. Translate chemical equations into a statement and vice versa.
16. Classify basic reaction types.
18. Identify spectator ions and write a net ionic equation.
19. Predict the molecular formulas of all potential products in simple chemical reactions.
20. Describe the differences between ionic bonding and covalent bonding and classify compounds as ionic or covalent (molecular).
21. Predict compound formulae using the octet rule.
22. Identify and define polar and non-polar bonds.
23. Predict the relative polarity of a bond using general trends in electronegativity along with the periodic table.
24. Predict bond and molecular polarity.
25. Draw electron dot structures for a molecule.
26. Identify bonding electrons, nonbonding electrons, single bonds, double bonds and triple bonds in an electron dot structure.
27. Predict the shape and bond angles using the VSEPR model.
28. Predict how bond angles are affected by electronic and steric interactions.
29. Describe the three most common phases of matter on a molecular level.
33. Identify common acids and bases and list where some are commonly encountered in daily life.
34. Calculate [H⁺], pH, [OH⁻], and pOH values for aqueous solutions and evaluate the acidity/alkalinity of a solution.
35. Distinguish between strong acids and weak acids qualitatively
General Chemistry II – 100 level
UNM T CHEM 122

Course Description:
General Chemistry is a two semester course in chemistry. This is designed for science majors and students interested in the health sciences

Student Learning Outcomes:
At the conclusion of this course, the student should be able to recall the basic principles of some details of Chemistry, write formulas and balance equations and solve problems related to the objectives for this course. The student should also be able to describe chemical equilibria, acid-base equilibria, point out basic properties of materials, and have an introductory concept of organic and biological chemistry.
General Chemistry II Lab – 100 level
UNM T CHEM 124L

Course Description:
Practice in laboratory measurements, in performing chemical reactions and in chemical calculations.

Student Learning Outcomes:
At the conclusion of this course, the student will have an enhanced understanding of methods and skills needed in a chemical laboratory setting. Students will be able to make clear and concise observations and be able to translate those observations into recorded form in a laboratory notebook.
Elements of General Chemistry – 100 level
UNM V CHEM 111

Course Description:
One-semester course in general chemistry, especially for non-science majors in the health sciences except pre-medicine and medical technology. (Credit not allowed for both CHEM 111 and CHEM 121L.) Meets New Mexico Lower Division General Education Common Core Curriculum Area III: Science (NMCCN 1114).

Student Learning Outcomes:
At the end of this course, you should be able to:
1. Use dimensional analysis, the SI system of units and appropriate significant figures to express quantities, convert units and perform quantitative calculations in science.
2. Diagram the structure of the atom in terms of its subatomic particles. Justify the existence and nature of the subatomic particles and the scale of the nucleus using appropriate experiments from scientific history.
3. Use the IUPAC system of nomenclature and knowledge of reaction types to describe chemical changes, predict products and represent the process as a balanced equation.
4. Apply the mole concept to amounts on a macroscopic and a microscopic level and use this to perform stoichiometric calculations including for reactions in solution and gases.
5. Apply the gas laws and kinetic molecular theory to relate atomic level behavior to macroscopic properties.
6. Describe the ways in which atoms combine to form molecules (ionic and covalent). Apply knowledge of electronic structure to determine molecular structure, geometry and hybridization.
7. Analyze how periodic properties (valence, electronegativity, etc.) and reactivity of elements result from electron configurations of atoms.
8. Explain the intermolecular attractive forces that determine physical properties; apply this knowledge to qualitatively evaluate these forces and predict the physical properties that result.
9. Calculate solution concentrations in various units and explain the effects of temperature, pressure and structure on solubility.
10. Explain rates and rate laws; determine the rate, rate law and rate constant of a reaction and calculate concentration as a function of time and vice versa.
11. Explain the collision model of reaction dynamics, including activation energy, catalysts and temperature; derive a rate law from a reaction mechanism and evaluate the consistency of a mechanism with a given rate law.
13. Describe the dynamic nature of chemical equilibrium and its relation to reaction rates; apply Le Chatelier’s Principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures.
14. Describe the equilibrium constant and use it to determine whether equilibrium has been established; calculate equilibrium constants from equilibrium concentrations and vice versa.
15. Describe the different models of acids and base behavior and recognize common acids and bases.
16. Apply equilibrium principles to aqueous solutions, including acid-base and solubility reactions; calculate pH and species concentrations in buffered and unbuffered solutions.
17. Recognize the basic radioactive decay modes, compare the penetrating and ionizing power of various types of radiation, fill in a missing species in a balanced nuclear equation and perform half-life calculations for radioactive isotopes.
General Chemistry II Lab – 100 level
UNM V CHEM 124L

Course Description:
Continued practice in laboratory experimentation reinforcing topics taught in the second semester of General Chemistry.

Student Learning Outcomes:
1. Conduct laboratory experiments safely by wearing appropriate protection and by handling and disposing of chemicals correctly.
2. Prepare scientific graphs to demonstrate quantitative relationships between variables.
3. Prepare solutions and dilutions accurately and correctly.
4. Demonstrate mastery in experimental techniques and measurements including: titrations, spectrophotometric measurements, vacuum filtrations, monitoring reaction rates, pH measurements, and voltage measurements from electrochemical cells.
5. Write appropriate hypotheses for lab questions based on observations and scientific theories.
6. Properly use a lab notebook to record experimental data and observations with correct significant figures and units.
7. Make meaningful analysis of experimental data and summarize the results in a proper format.
8. Communicate scientific arguments effectively and logically in a written and an oral form.
Chemistry for Life – 100 level  
WMU CHEM 121

Course Description:
The students will obtain a well-reinforced understanding of the behavior of matter based on visualizing the world around them as consisting of atoms and molecules. The concepts they will learn include classification of matter and measurement of its properties, density, atomic structure including isotopes and the mole concept, chemical nomenclature and formulas, hydrated compounds, balancing chemical equations, stoichiometry including limiting reactant, introduction to the basic types of chemical reactions, acid/base chemistry, pH, redox reactions, chemical bonding, introduction to organic chemistry and introduction to biochemistry. Students will learn logical problem-solving skills, including strategies to attack complicated problems in chemistry by step-by-step analysis, techniques which will be useful in every area of their lives.

Student Learning Outcomes:  
Not provided
Chemistry for Life Laboratory – 100 level
WNMU CHEM 123

Course Description:
Introduction to chemistry covering general, and organic; can be used for general education and nursing requirements (requires some algebra. This course is broader in scope but less intense and/or mathematical on specific topics than General Chemistry 151, 152). This course does not constitute a prerequisite for chemistry majors.

Student Learning Outcomes:
A successful student will learn these basics of chemistry: proper laboratory safety, proper measuring techniques & equipment, an understanding of the concepts of elements, atoms, ions, compounds, moles and how chemists measure them, and an understanding of the concepts of chemical reactions and quantitative analysis of reaction products.
General Chemistry II Laboratory – 100 level
WNMU CHEM 154

Course Description:
This course is designed to teach the student basic lab skills needed to work in a chemistry lab. The objective is to introduce the student to chemistry and to demonstrate techniques chemists use to solve problems. The laboratory will cover various techniques of measurement. The scientific notebook is used and the lab report is emphasized.

Student Learning Outcomes:
A successful student will learn these basics of chemistry: proper laboratory safety, proper measuring techniques & equipment, an understanding of the concepts of elements, atoms, ions, compounds, moles and how chemists measure them, and an understanding of the concepts of chemical reactions and quantitative analysis of reaction products.