CHEMISTRY (CHEM)

CHEM 1111 Basic Chemistry 3 Credits (3)
For students whose preparatory science or math training has been deficient. Does not meet the chemistry requirement in any curriculum.
Prerequisite(s): Enhanced ACT composite score of at least 18 or a grade of C- or better in CCDM 114 N
Learning Outcomes
1. The goals and objectives for CHEM 1111 are to equip students with the necessary problem solving skills to be successful in CHEM 1216C/1226C

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CHEM 1120G Introduction to Chemistry Lecture and Laboratory (non majors) 4 Credits (4)
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. (3+3P)
Prerequisite(s): CCDM 114 or MATH 1215 or higher
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.

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CHEM 1121 General Supplemental Instruction I 1 Credit (1)
Collaborative workshop for students in General Chemistry I. Course does not count toward departmental degree requirements. Repeatable: for a maximum of 2 credits.
Learning Outcomes
1. Collaborative workshop for students in General Chemistry I. Course does not count toward departmental degree requirements. May be repeated for a maximum of 2 credits

View Course Outcomes

CHEM 1122 General Supplemental Instruction II 1 Credit (1)
Collaborative workshop for students in General Chemistry II. Course does not count toward departmental degree requirements. Repeatable: for a maximum of 2 credits.
Learning Outcomes
1. See course syllabus.

View Course Outcomes

CHEM 1123 Principles of Supplemental Instruction III 1 Credit (1)
Collaborative workshop for students in CHEM 110G, Principles and Applications of Chemistry. Does not count toward departmental degree requirements. Repeatable: for maximum of 2 credits.
Learning Outcomes
1. See course syllabus.

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CHEM 1215G General Chemistry I Lecture and Laboratory for STEM majors 4 Credits (4)
This course covers descriptive and theoretical chemistry. (3+3P)
Prerequisite(s): (1) grade of C- or better in MATH 1215 or higher, or a Mathematics Placement Exam Score adequate to enroll in mathematics courses beyond MATH 1215
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.

View Course Outcomes

CHEM 1216 General Chemistry 4 Credits (4)
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 included. Provides lab.
Prerequisite(s): Eligible to take MATH 1250G and an ACT composite score of 22 or higher
Provides Lab
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CHEM 1225G General Chemistry II Lecture and Laboratory for STEM Majors 4 Credits (4)
This course is intended to serve as a continuation of general chemistry principles for students enrolled in science, engineering, and certain preprofessional 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.
Prerequisite(s): C- or better in CHEM 1215G
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.

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CHEM 1226 General Chemistry II 4 Credits (4)
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 and other physical sciences, including engineering. May be appropriate for the life science major. It is assumed that the students are familiar with college algebra, chemical nomenclature, stoichiometry, and scientific measurements. 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. (3+3P) Provides lab.
Prerequisite(s): C- or better in CHEM 1216
Provides Lab
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.

View Course Outcomes

CHEM 2111 Explorations in Chemistry 1 Credit (1)
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.
Learning Outcomes
1. Understand how to use the road map for the B.S. or B.A. in Chemistry to develop a curriculum plan toward degree completion.
2. Become familiar with Chemistry and related student organizations for potential participation.
3. Understand the breadth of available undergraduate research opportunities and related training programs.
4. Identify potential career paths for students graduating with a degree in Chemistry.
5. Become familiar with resources available for exploring current topics in Chemistry.

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CHEM 2115C Survey of Organic Chemistry and Laboratory 4 Credits (4)
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. (3+3P) Provides lab.
Prerequisite(s): C- or better in CHEM 1225G or CHEM 1226
Provides Lab
View Course Outcomes

CHEM 2120 Integrated Organic Chemistry and Biochemistry 3 Credits (3)
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.
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.

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CHEM 2226 General Chemistry III 3 Credits (3)
Quantitative aspects of general chemistry: solid state structure, equilibrium, thermodynamics, and kinetics. Required of chemical science majors who have taken CHEM 1215G/1225G. (2+3P)
Prerequisite(s): CHEM 1225G
Learning Outcomes
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

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CHEM 2991 Directed Research in Chemistry 3 Credits (3)
Techniques and procedures of chemical research. (3+9P) Repeatable: for a maximum of 3 credits.
Prerequisite(s): 8 credits of chemistry and a 3.0 GPA in chemistry
Learning Outcomes
1. Varies

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CHEM 2996 Topics in Chemistry 1-6 Credits
Specific subjects in Chemistry. These subjects will be announced in the Schedule of Classes. Repeatable: under different topics for a maximum of 12 credits.
Learning Outcomes
1. Varies

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