Course Title: Chemistry II
Board Approval Date: 06/16/14
Credit / Hours: 1 credit

Course Description:

Many topics are presented to Chemistry II students. Pertinent theories from Chemistry I are reviewed and expanded upon including measurement, atomic structure, molarity, normality, nomenclature, chemical equations, pH, and acids and bases. Theories are reinforced through application of mathematical solutions to theoretical word problems. Chemical reactions are studied in the following terms: thermodynamics – energy involved in reactions and reaction spontaneity; kinetics – factors affecting reaction rates; dynamic equilibrium – factors affecting extent of a reaction; and reduction oxidation – electron exchange and electrical potential in reactions.

Learning Activities / Modes of Assessment:

Large group instruction
Laboratory experiments
Small group work
Computer simulations / Video Analysis
Reading assignments
Tests and Quizzes
Checklists / Teacher Observation
Lab Reports / Write-ups

Instructional Resources:

Text books: *Chemistry: The Central Science* Glencoe Science Brown, Lemay, and Bursten
Introduction to Organic Chemistry Brown
Online text resources through Pearson-Prentice-Hall
Videos: Bill Nye the Science Guy, Myth Busters, videos and video clips available through Discovery Ed Streaming, videos and video clips available through Central Columbia S.D. Educational Video Library
Online tutorials and quizzes available online at Quia.com

Course Pacing Guide

Course: **Chemistry II**

Course Unit (Topic)	**Length of Instruction (Days/Periods)**
1. Electronic Structure	20 days
2. Stoichiometry	23 days
3. Periodic Table and Trends in Properties of Elements	10 days
4. Bonds and Geometries	20 days
5. Organic Functional Groups	10 days
6. Atomic Arrangement-Resonance and Isomers	14 days
7. Intermolecular Forces	12 days
8. Solutions	16 days
9. Thermodynamics	20 days
10. Kinetics and Reaction Rates	10 days
11. Equilibrium	25 days
DAYS TOTAL	180 Days

9.

Topic: 01 Electronic Structure
Days: 20
Subject(s):
Grade(s):

Know:	Understand:	Do:
S11.C.1.1.1 – Unranked Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., proton, neutrons, electrons). The Relationship between Light and Electrons: continuous spectrum, electromagnetic radiation, frequency, (bright) line or emission spectrum, photon, Planck's constant, quantum, spectrum How to describe the properties of light and its dual nature How electrons are affected when they absorb or release energy as they are orbiting the nucleus within an atom How electrons are arranged within an atom according to the Bohr and Quantum models of the atom How to use an atom's electron configuration to determine the charge it would have as an ion	Understanding the arrangements of the electrons leads to better understanding of the patterns in bonding, chemical properties, chemical reactions, and periodic properties.	**3.2.C.A2.a – Essential** STRUCTURE OF MATTER - Compare the electron configurations for the first twenty elements of the periodic table. **3.2.C.A2.b – Essential** STRUCTURE OF MATTER - Relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements in the table. **S11.C.2.1.1 – Unranked** Compare or analyze different types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels, and motion. 3.2.C.A2.a - STRUCTURE OF MATTER - Compare the electron configurations for the first twenty elements of the periodic table. 3.2.C.A2.b - STRUCTURE OF MATTER - Relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements in the table. S11.C.1.1.1 - Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., proton, neutrons, electrons). S11.C.2.1.1 - Compare or analyze different types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels, and motion.

Topic: 02 Stoichiometry
Days: 23
Subject(s):
Grade(s):

Know:	Understand:	Do:
Student is able write names and formulas for ionic, inorganic acidic, and binary molecular compounds. acid, anion, cation, oxyanion, polyatomic ion, ionic compound, binary molecular compound Student uses reasoning and develops a sequence of steps to solve complex chemical problems. theoretical yield, actual yield, limiting reagent, excess reagent, Avogadro's number, stoichiometry, empirical formula, molecular formulaStudent is able write names and formulas for ionic, inorganic acidic, and binary molecular compounds. Student is able to write and balance chemical equations. Student is able to determine the products of a chemical reaction after combining the reactants and collecting and analyzing the products. single replacemant, double replacement, combination reaction,	Mathematical relationships are important to understanding experimental data and results.	**3.2.C.A4.c – Essential** REACTIONS - Balance chemical equations by applying the laws of conservation of mass. **3.2.C.A4.d – Essential** REACTIONS - Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. **3.2.C.A4.e – Essential** REACTIONS - Use stoichiometry to predict quantitative relationships in a chemical reaction. **3.2.C.A2.f – Essential** STRUCTURE OF MATTER - Predict the chemical formulas for simple ionic and molecular compounds. **3.2.C.A2.g – Essential** STRUCTURE OF MATTER - Use the mole concept to determine number of particles and molar mass for elements and compounds. **3.2.C.A2.h – Important** STRUCTURE OF MATTER - Determine percent compositions, empirical formulas, and molecular formulas. 3.2.C.A4.c - REACTIONS - Balance chemical equations by applying the laws of conservation of mass. 3.2.C.A4.d - REACTIONS - Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. 3.2.C.A4.e - REACTIONS - Use stoichiometry to predict quantitative relationships in a chemical reaction. 11-12.R.S.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 11-12.R.S.4 - Determine the meaning of symbols,

Topic: 02 Stoichiometry
Days: 23
Subject(s):
Grade(s):

Know:	Understand:	Do:
combustion reaction, decomposition reaction		key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics. 3.2.C.A4.a - REACTIONS - Predict how combinations of substances can result in physical and/or chemical changes.

Topic: 03 Periodic Table and Trends in Properties of Elements
Days: 10
Subject(s):
Grade(s):

Know:	Understand:	Do:
CHEM.A.2.3.1 – Important Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table. **CHEM.A.2.3.2 – Important** Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends. periodicity of chemical properties electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius	The periodic table is organized in repeating patterns of elements' properties.	**3.2.C.A1.c – Essential** PROPERTIES OF MATTER - Explain the relationship of an element's position on the periodic table to its atomic number, ionization energy, electro-negativity, atomic size, and classification of elements. **S11.C.1.1.2 – Unranked** Explain the relationship between the physical properties of a substance and its molecular or atomic structure. **S11.C.1.1.4 – Unranked** Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table. **S11.A.3.3.1 – Unranked** Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order. **CHEM.A.2.3.1 – Important** Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table. **CHEM.A.2.3.2 – Important** Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends. 3.2.C.A1.c - PROPERTIES OF MATTER - Explain the relationship of an element's position on the periodic table to its atomic number, ionization energy, electro-negativity, atomic size, and classification of elements. S11.C.1.1.2 - Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.4 - Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table. S11.A.3.3.1 - Describe or interpret recurring patterns that form the basis of biological classification,

Topic: 03 Periodic Table and Trends in Properties of Elements
Days: 10
Subject(s):
Grade(s):

Know:	Understand:	Do:
		chemical periodicity, geological order, or astronomical order. CHEM.A.2.3.1 - Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table. CHEM.A.2.3.2 - Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends.

Topic: 04 Bonds & Geometries
Days: 20
Subject(s):
Grade(s):

Know:	Understand:	Do:
Predict the type of bond that 2 atoms would form. Draw acceptable Lewis dot diagrams for molecules. Examine given Lewis dot diagrams for a molecule and determine which would be most like the true molecule. Use VSEPR theory to determine and the shape of a molecule. Explain what hybridized orbitals are and why atoms hybridize before bonding. Use molecular orbital theory to describe some properties of molecules. covalent bond, ionic bond, electronegativity, polar covalent bond Lewis dot diagram, formal charge, bond order VSEPR, bond angle, pi bond, sigma bond antibonding orbitals, diamagnetism, hybrid orbital, molecular orbital, MO diagram, paramagnetism, valence-bond theory	How atoms form bonds determines the type of bond. Molecular geometries determine the properties of substances.	**3.2.C.A1.d – Essential** PROPERTIES OF MATTER - Use electro-negativity to explain the difference between polar and nonpolar covalent bonds. **3.2.C.A2.c – Important** STRUCTURE OF MATTER - Explain how atoms combine to form compounds through both ionic and covalent bonding. 3.2.C.A1.d - PROPERTIES OF MATTER - Use electro-negativity to explain the difference between polar and nonpolar covalent bonds. 3.2.C.A2.c - STRUCTURE OF MATTER - Explain how atoms combine to form compounds through both ionic and covalent bonding.

Topic: 05 Organic Functional Groups
Days: 10
Subject(s):
Grade(s):

Know:	Understand:	Do:
Number prefixes for counting carbons Number prefixes for counting carbon branches and functional groups Suffixes used to identify types of bonds among carbon molecules Organic functional groups and how to name molecules containing those groups alkane, alkene, alkyne, cycloalkane, alkyl group, hydrocarbon, saturated hydrocarbon, substituent amide, amine, aldehyde, aromatic, ester, ether, functional group, ketone, carbonyl, carboxylic acid	The IUPAC system is a methodical way to identify organic molecules and their functional groups.	**S11.B.1.1.1 – Unranked** Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). **S11.C.1.1.2 – Unranked** Explain the relationship between the physical properties of a substance and its molecular or atomic structure. **S11.C.1.1.3 – Unranked** Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent). **CHEM.A.1.1.4 – Essential** Relate the physical properties of matter to its atomic or molecular structure. **CHEM.A.1.1.5 – Essential** Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions). S11.B.1.1.1 - Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). S11.C.1.1.2 - Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.3 - Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent). CHEM.A.1.1.4 - Relate the physical properties of matter to its atomic or molecular structure. CHEM.A.1.1.5 - Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions).

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Topic: 06 Atomic Arrangement:Resonance and Isomers
Subject(s):

Days: 14
Grade(s):

Know:	Understand:	Do:
How to draw resonance structures Explain how resonance affects the properties of a substance, contrasting with properties of substances that do not exhibit resonance How to draw various types of isomeric structures resonance, configurational isomer, aromatic molecules, optical isomer, isomer, chiral, strucutural isomer, enantiomers, stereoisomer, diastereomers, cis-trans isomerism, racemic mixture, conformational isomer, delocalized electrons	The arrangement of atoms determines the properties of molecules.	**S11.B.1.1.1 – Unranked** Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). **S11.C.1.1.2 – Unranked** Explain the relationship between the physical properties of a substance and its molecular or atomic structure. **S11.C.1.1.3 – Unranked** Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent). S11.B.1.1.1 - Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). S11.C.1.1.2 - Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.3 - Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).

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Course: Chemistry II (06/16/14)

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Topic: 07 Intermolecular Forces

Days: 12

Subject(s):

Grade(s):

Know:	Understand:	Do:
Determine the types of intermolecular forces that exist in a given substance Explain how the physical properties of substances are determined by their intermolecular forces Differentiate between physical properties and chemical properties. Differentiate between pure substances and mixtures;differentiate between heterogeneous and homogeneous mixtures. capillary action, hydrogen bonding, triple point, induced dipole, dipole-dipole force, London-dispersion force, vapor, dipole moment, phase diagram, vapor pressure, intermolecular forces, polarizability, viscosity, ion-dipole forces, surface tension, volatile	Substances interact even if they are not chemically reacting.	**3.2.C.A1.a – Essential** PROPERTIES OF MATTER - Differentiate between physical properties and chemical properties. **3.2.C.A1.b – Essential** PROPERTIES OF MATTER - Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. 3.2.C.A1.a - PROPERTIES OF MATTER - Differentiate between physical properties and chemical properties.

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Topic: 08 Solutions
Subject(s):

Days: 16
Grade(s):

Know:	Understand:	Do:
Determine the concentration of a given solution Explain and diagram the process of dissolving for ionic and molecular substances Identify strong acids and bases Identify weak acids and bases Write and balance metathesis reactions pure substances and mixtures differentiate between heterogeneous and homogeneous mixtures. concentration, molecular equation, solvent, dilution, nonelectrolyte, spectator ion, electrolyte, solubility, strong electrolyte, metathesis reaction, solute, tincture, molarity, solvation, weak electrolyte	Solutions are important in conducting experiments.	**3.2.C.A1.b – Essential** PROPERTIES OF MATTER - Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. **3.2.C.A2.c – Important** STRUCTURE OF MATTER - Explain how atoms combine to form compounds through both ionic and covalent bonding. **3.2.C.A2.e – Essential** STRUCTURE OF MATTER - Draw Lewis dot structures for simple molecules and ionic compounds. 3.2.C.A1.b - PROPERTIES OF MATTER - Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. 3.2.C.A2.c - STRUCTURE OF MATTER - Explain how atoms combine to form compounds through both ionic and covalent bonding. 3.2.C.A2.e - STRUCTURE OF MATTER - Draw Lewis dot structures for simple molecules and ionic compounds.

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Topic: 09 Thermodynamics
Subject(s):

Days: 20
Grade(s):

Know:	Understand:	Do:
Calculate energy changes for a chemical reaction. Use Hess's Law in multiple methods and problems Use enthalpy values in chemical equations Determine if a process or reaction is spontaneous Explain how entropy changes are related to the spontaneity of a reaction or process. Calulate Gibbs free energy to determine if a reaction is sponataneous . thermodynamics enthalpy entropy Gibbs free energy Hess's law	Calculating the absorption or release of energy by a chemical reaction can determine if the reaction will occur.	**SI.11-12.2 – Essential** Evaluate experimental information for relevance and adherence to science processes. **SI.11-12.3 – Essential** Judge that conclusions are consistent and logical with experimental conditions. **SI.11-12.5 – Essential** Communicate and defend a scientific argument. **S11.C.2.1.2 – Unranked** Describe energy changes in chemical reactions. SI.11-12.2 - Evaluate experimental information for relevance and adherence to science processes. SI.11-12.3 - Judge that conclusions are consistent and logical with experimental conditions. SI.11-12.5 - Communicate and defend a scientific argument. S11.C.2.1.2 - Describe energy changes in chemical reactions.

Topic: 10 Kinetics and Reactions Rates
Days: 10
Subject(s):
Grade(s):

Know:	Understand:	Do:
Identify the roles of different chemicals in a reaction mechanism Explain the importance of a rate-determining step Explain the postulates of the collision theory of reactions Write a rate law for a reaction Calculate the concentration of a chemical as the reaction proceeds through time Determine the half-life of a chemical reaction activated complex, elementary steps, rate law, activation energy, first-order reaction, rate-determining step, catalyst, half-life, reaction mechanism, chemical kinetics, instantaneous rate, reaction order, collision model, intermediate, reaction rate, rate constant, second-order reaction	The speed and processes (mechanics) of chemical reactions can be determined.	**S11.C.1.1.6 – Unranked** Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, catalyst, temperature, agitation). S11.C.1.1.6 - Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, catalyst, temperature, agitation).

Topic: 11 Equilibrium
Days: 25
Subject(s):
Grade(s):

Know:	Understand:	Do:
Explain why equilibrium is a dynamic situation Determine the direction a reaction will go given initial concentrations Determine how an equilibrium system will change in response to a stress Kc expressions, chemical equilibrium, homogeneous equilibria, equilibrium constant, law of mass action, equilibrium expression, le Châtelier's principle, heterogeneous equilibria, reaction quotient	Chemical reactions don't always go to completion.	3.2.12.A5.b - UNIFYING THEMES - CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.