Chemistry Honors

Curriculum Guide

2022-2023

Subject: Chemistry Honors

Teacher Curriculum Guide

Matter and Its Interactions (PS1)		
C-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. ***Clarification Statement:*** *Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.* ***State Assessment Boundary:*** *Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). Use a model to predict the relationships between systems or between components of a system. NRC Framework Link	**PS1.A: Structure and Properties of Matter** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. NRC Framework Link	**Patterns** Different patterns may be observed at which a system is studied and can provide evidence for causality in explanations of phenomena. NRC Framework Link

Matter and Its Interactions (PS1)		
C-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. ***Clarification Statement:*** *Examples of chemical reactions could include the reaction of sodium and chlorine, carbon and oxygen, carbon and hydrogen, or biochemical reactions.* ***State Assessment Boundary:*** *Assessment is limited to chemical reactions involving main group elements and combustion reactions.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. NRC Framework Link	**PS1.A: Structure and Properties of Matter** The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. NRC Framework Link **PS1.B: Chemical Reactions** The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. NRC Framework Link	**Patterns** Different patterns may be observed at which a system is studied and can provide evidence for causality in explanations of phenomena. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Matter and Its Interactions (PS1)		
C-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at a bulk scale to infer the strength of various forces between particles. ***Clarification Statement:*** *Emphasis is on understanding the strengths of forces between particles, NOT on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Macroscopic properties of substances at the bulk scale could include the melting point and boiling point, vapor pressure, and surface tension.* ***State Assessment Boundary:*** *Assessment does not include Raoult's law calculations of vapor pressure.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. NRC Framework Link	**PS1.A: Structure and Properties of Matter** The structure and interactions of matter at the broader level are determined by various forces within and between atoms. NRC Framework Link **PS2.B: Types of Interactions** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. NRC Framework Link	**Patterns** Different patterns may be observed at which a system is studied and can provide evidence for causality in explanations of phenomena. NRC Framework Link

Matter and Its Interactions (PS1)		
C-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. ***Clarification Statement:*** *Emphasis is on the idea that a chemical reaction is a system that affects the energy change and is due to the absorption of energy when bonds are broken and the release of energy when new bonds are formed. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved. Examples could include photosynthesis and cell respiration.* ***State Assessment Boundary:*** *Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Model Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). Develop a model based on evidence to illustrate the relationships between systems or between components of a system. NRC Framework Link	**PS1.A: Structure and Properties of Matter** A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. NRC Framework Link **PS1.B: Chemical Reactions** Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. NRC Framework Link	**Energy and Matter** Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Matter and Its Interactions (PS1)		
C-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. ***Clarification Statement:*** *Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules. Examples could include enzymes or biocatalytic reactions.* ***State Assessment Boundary:*** *Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. NRC Framework Link	**PS1.B: Chemical Reactions** Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. NRC Framework Link	**Patterns** Different patterns may be observed at which a system is studied and can provide evidence for causality in explanations of phenomena. NRC Framework Link

Matter and Its Interactions (PS1)		
C-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. ***Clarification Statement:*** *Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants, removing products, or chemical kinetics.* ***State Assessment Boundary:*** *Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. NRC Framework Link	**PS1.B: Chemical Reactions** In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. NRC Framework Link **ETS1.C: Optimizing the Design Solution** Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary)* NRC Framework Link	**Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Matter and Its Interactions (PS1)

C-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Clarification Statement: *Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants, removing products, or chemical kinetics.*
State Assessment Boundary: *Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. NRC Framework Link	**PS1.B: Chemical Reactions** In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. NRC Framework Link **ETS1.C: Optimizing the Design Solution** Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary)* NRC Framework Link	**Stability and Change** Much of science deals with constructing explanations of how things change and how they remain stable. NRC Framework Link

Matter and Its Interactions (PS1)

C-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Clarification Statement: *Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale (stoichiometry). Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem- solving techniques.*
State Assessment Boundary: *Assessment does not include complex chemical reactions.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 and experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical representations of phenomena to support claims. NRC Framework Link	**PS1.B: Chemical Reactions** The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. NRC Framework Link	**Energy and Matter** The total amount of energy and matter in closed systems is conserved. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Matter and Its Interactions (PS1)

C-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Clarification Statement: *Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.*
State Assessment Boundary: *Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Model Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). Develop a model based on evidence to illustrate the relationships between systems or between components of a system. NRC Framework Link	**PS1.C: Nuclear Processes** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. NRC Framework Link	**Energy and Matter** In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. NRC Framework Link

Motion and Stability: Forces and Interactions (PS2)

C-PS2-6. Communicate scientific and technical information about why the molecular structure determines the functioning of designed materials.

Clarification Statement: *Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.*
State Assessment Boundary: *Assessment is limited to provided molecular structures of specific designed materials.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. Communicate scientific and technical information (e.g., about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). NRC Framework Link	**PS1.A: Structure and Properties of Matter** The structure and interactions of matter at the broader level are determined by various forces within and between atoms. NRC Framework Link **PS2.B: Types of Interactions** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. NRC Framework Link **ETS1.C: Optimizing the Design Solution** Determining what constitutes "best," however, requires value judgments, given that one person's view of the optimal solution may differ from another's. *(secondary)* NRC Framework Link	**Structure and Function** Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Energy (PS3)

C-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Clarification Statement: *Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.*
State Assessment Boundary: *Assessment is limited to investigations based on materials and tools provided to students.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. NRC Framework Link	**PS3.B: Conservation of Energy and Energy Transfer** Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). NRC Framework Link **PS3.D: Energy in Chemical Processes and Everyday Life** Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. NRC Framework Link	**Systems and System Models** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. NRC Framework Link

Waves and Their Applications in Technologies for Information Transfer (PS4)

C-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

Clarification Statement: *Emphasis is on the idea that particles associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.*
State Assessment Boundary: *Assessment is limited to qualitative descriptions.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible. NRC Framework Link	**PS4.B: Electromagnetic Radiation** When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. Atoms of each element emit and absorb characteristic frequencies of light and nuclear transitions have distinctive gamma ray wavelengths, which allows identification of the presence of an element. NRC Framework Link	**Cause and Effect** Cause-and-effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. NRC Framework Link

Subject: Chemistry Honors

Teacher Curriculum Guide

Waves and Their Applications in Technologies for Information Transfer (PS4)		
C-PS4-5. Communicate technical information about how some technological devices use the principles of the electromagnetic spectrum to cause matter to transmit and capture information and energy. ***Clarification Statement:*** *Examples could include medical imaging and communications technology.* ***State Assessment Boundary:*** *Assessments are limited to qualitative information. Assessments do not include band theory.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). NRC Framework Link	**PS4.B: Electromagnetic Radiation** Photoelectric materials emit electrons when they absorb light of a high-enough frequency. NRC Framework Link **PS4.C: Information Technologies and Instrumentation** Multiple technologies based on the understanding of energy and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. NRC Framework Link **ETS2.A: Interdependence of Science, Engineering, and Technology** Science and engineering complement each other in the cycle known as research and development (R&D). *(secondary)* NRC Framework Link (continued next page)	**Cause and Effect** Systems can be designed to cause a desired effect of energy interactions of matter. NRC Framework Link
	ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World Modern civilization depends on major technological systems. *(secondary)* NRC Framework Link	

Subject: Chemistry Honors

Teacher Curriculum Guide

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

Semester One

South Carolina College-and Career-Ready Standards	
H.C.4A.1 - Develop and use models to explain the arrangement and movement of the particles in solids, liquids, gasses, and plasma as well as the relative strengths of their intermolecular forces.	H.C.4A.2 - Analyze and interpret heating curve graphs to explain that changes from one state of matter to another are energy dependent.

Unit 1: States of Matter Unit Focus: Students will review the basic fundamentals of matter and its properties.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC4A1 HC4A2	I can : ● Describe lab safety and procedures ● Understand states of matter - solids/liquids/gasses/substances/mixtures ● Understand how to classify matter: Particulate level Drawings, physical vs chemical changes ● Change of State: ● Define temperature and heat. ● Describe the motion of particles in all states of matter according to the kinetic molecular theory. ● Describe the process of changing state	3 Days	Prentice Hall Chemistry 2008	Quizizz States of Matter: Basics Phet States of Matter.pdf Separation of a Mixture Lab.docx Heating and Cooling Curve Graphing Density Assignment.docx

	(vaporization, condensation, freezing, melting, sublimation, and deposition). ● Examine Particulate level drawings relating to Energy, heating and cooling curves ● Write and read numbers in scientific notation. ● Complete math problems using numbers in scientific notation. ● Complete dimensional analysis problems for converting units. ● Density Calculations, significant figures, unit conversions ● Density graphing slope			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
C-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	H.C.2A.2 - Use the Bohr and quantum mechanical models of atomic structure to exemplify how electrons are distributed in atoms.
HC2 The student will demonstrate an understanding of atomic structure and nuclear processes.	H.C.2A.3 - Analyze and interpret absorption and emission spectra to support explanations that electrons have discrete energy levels.
H.C.2A.1 - Obtain and communicate information to describe and compare subatomic particles with regard to mass, location, charge, electrical attractions and repulsions, and impact on the properties of an atom.	

Unit 2: Atomic Structure Unit Focus: Students will focus on the atom and fundamentals of the periodic table.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
CPS1.1 HC2 HC2A1 HC2A2 HC2A3	I can : ● Understand the basic layout of the periodic table, structure of the atom and subatomic particles, Bohr Model and Lewis Dot structure ● Atomic Theory, Ion, Ion Formation, Dot structures and Isotopes ● Isotopes, Isotopic Notation and Average Atomic Mass ● Electron Structure, Electron	8 Days	Prentice Hall Chemistry 2008	Labeling Periodic table Phet Interactive Build an Atom Beanium Isotope Lab.doc (live.com) M and M Atom Model (exo.net) Atomic Electron Configurations Spectral Analysis Lab

	Configuration, Orbital Notation ● Behavior of Electrons/ Electromagnetic Spectrum ● Deduce the relationship between number of energy levels and period. ● Define "Valence Electron". ● Deduce the relationship between number of valence electrons and group. Recognize the similarity in chemical properties related to the number of valance electrons and the group on the periodic table. ● Given an element, draw the Lewis Dot structure. ● Identify the s, p, d, and f regions on the periodic table. ● Define atomic orbitals. ● Describe the basic shapes of s,p,d,f orbitals. ● Recall that each orbital of any shape can hold up to 2 electrons.			

	● Explain the “nesting” nature of principle energy levels, sublevels, orbital, spin. ● Understand Periodic Table Trends (Atomic Radius, Ionization Energy, and Electronegativity)			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.3 The student will demonstrate an understanding of the structures and classification of chemical compounds. Conceptual Understanding	H.C.6A.1 Develop and use models to predict the products of chemical reactions (1) based upon movements of ions; (2) based upon movements of protons; and (3) based upon movements of electrons.
H.C.3A Elements are made up of only one kind of atom. With increasing atomic number, a predictable pattern for the addition of electrons exists. This pattern is the basis for the arrangement of elements in the periodic table. The chemical properties of an element are determined by an element's electron configuration. Elements can react to form chemical compounds/molecules that have unique properties determined by the kinds of atoms combined to make up the compound/molecule. Essentially, the ways in which electrons are involved in bonds determines whether ionic or covalent bonds are formed. Compounds have characteristic shapes that are determined by the type and number of bonds formed.	H.C.6A.3

Unit 3: Naming Compounds Unit Focus: Students will learn naming basics and how to write their corresponding formulas.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC3 HC3A1,2,3 HC6A1 HC6A3	I can : ● Distinguish between Ionic and Covalent Compounds ● Understand the difference between Covalent vs Ionic Bonding and the Octet Rule, reinforce lewis dot structures ● Understand Monatomic, Diatomic	5 Days	Prentice Hall Chemistry 2008	Lab - Ionic vs Covalent Practice Worksheets POGIL worksheet for remedial help Quia - Naming Ionic Compounds: Who Wants to be a Millionaire? The Chemistry Name Game

	and Binary Compounds ● Name and Writing Formulas- Ternary Ionic, Polyatomic ● Name Acids/Bases, ● Name Hydrocarbons- basic Alkanes and Alkynes, basic Molecular Compounds			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.3A.3 - Analyze and interpret data to predict the type of bonding (ionic or covalent) and the shape of simple compounds by using the Lewis dot structures and oxidation numbers.	H.C.3A.6 - Construct explanations of how the basic structure of common natural and synthetic polymers is related to their bulk properties
H.C.3A.4 - Plan and conduct controlled scientific investigations to generate data on the properties of substances and analyze the data to infer the types of bonds (including ionic, polar covalent, and nonpolar covalent) in the simple compounds.	H.C.1A.2 - Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
H.C.3A.5 - Develop and use models (such as Lewis dot, structural formulas, or ball-and stick models) of simple hydrocarbons to exemplify structural isomerism.	H.C.5A.1 - Obtain and communicate information to describe how a substance can dissolve in water by dissociation, dispersion, or ionization and how intermolecular forces affect solvation.

Unit 4: Bonding

Unit Focus: Students will learn the differences between ionic and covalent compounds and the intermolecular forces that allow for this classification and the impact it has on states of matter.

Standards	Sequenced Objectives	Scope	Content-Location	Resources
HC3A3 HC3A4 HC3A5 HC3A6 HC1A2 HC5A1	I can : ● Distinguish between the properties of Ionic, Covalent and Metallic bonding. Chemical Bonding: ● Define chemical bonds. ● Explain why atoms form chemical bonds. ● Compare and contrast ionic and covalent bonding based on the elements involved, properties displayed,	7 Days	Prentice Hall Chemistry 2008	Lab: Gold Penny Lab - Google Docs Organic Modeling Lab Covalent Bonding Gizmo Molecule Shapes Polarity and IMF Gizmo Compare 4 White Unknown Compounds ● Determine properties ● Determine ionic or covalent ● Determine type of forces holding it together

	and formulas represented. ● Explain why most chemical bonding is neither purely ionic or purely covalent. ● Classify bonding type (ionic, polar covalent, nonpolar covalent) based on the electronegativity difference of the elements. ● Distinguish between polar and nonpolar molecules ● Define lattice energy and explain its significance. Metallic Bonding: ● Describe the electron-sea model of metallic bonding, and explain why metals are good conductors of electricity. ● Apply the Octet Rule and Exceptions to drawings of Covalent compounds. ● ● Apply the VSEPR Theory determining Shape and Polarity of a molecule. ● Understand Intermolecular Forces such as, hydrogen			

	bonding, dipole, and Van Der Waals Forces and how these forces impact the states of matter the molecule exists in.			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.6A.3 - Plan and conduct controlled scientific investigations to produce mathematical evidence that mass is conserved in chemical reactions.	HC7A1

Unit 5: Chemical Reactions Unit Focus: Applying naming rules students learn the different types of chemical reactions and how to predict and balance the outcomes of these reactions.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC6A3 HC7A1	I can : ● Write Chemical Reactions when given word equations or a sentence description ● Write a chemical equation. ● Balance chemical equations. ● Solve Combination Reactions, Decomposition Reactions, Single Replacement Reactions, Double Replacement Reactions, Hydrocarbon Combustion Reactions, Acid Base Neutralization (recognize) ● Classify reactions with particulate level drawings	10 Days	Prentice Hall Chemistry 2008	Chemical Reaction Lab Single Replacement Reactions

	• Determine Precipitate formation based on solubility rules • Describe the process of dissociation and the formation of an aqueous solution. • Use the activity series to predict whether a given single displacement reaction will occur and what the products will be. • Use the solubility rules to predict whether a given precipitation reaction will occur and what the products will be. • Identify Energy Changes in Chemical Reaction/ PE diagram; • Identify a Thermochemical Equation as Exothermic or Endothermic • Solve Net Ionic Equations • Solve oxidation reduction half reactions problems			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.4A.1 - Develop and use models to explain the arrangement and movement of the particles in solids, liquids, gasses, and plasma as well as the relative strengths of their intermolecular forces.	H.C.7A.1 - Analyze and interpret data from energy diagrams and investigations to support claims that the amount of energy released or absorbed during a chemical reaction depends on changes in total bond energy.
H.C.4A.2 - Analyze and interpret heating curve graphs to explain that changes from one state of matter to another are energy dependent.	H.C.7A.2 - Use mathematical and computational thinking to write thermochemical equations and draw energy diagrams for the combustion of common hydrocarbon fuels and carbohydrates, given molar enthalpies of combustion.

Unit 6: Thermochemistry
Unit Focus: Student learn the impact of energy and its forms specifically heat energy on reactions and their rates.

Standards	Sequenced Objectives	Scope	Content-Location	Resources
HC4A1 HC4A2 HC7A1 HC 7A2	I can: ● Interpret Change of State: ● Define temperature and heat. ● Describe the motion of particles in all states of matter according to the kinetic molecular theory. ● Describe the process of changing state (vaporization, condensation, freezing, melting, sublimation, and deposition).	4 Days	Prentice Hall Chemistry 2008	Why Cold Doesn't Exist | Energy Foundations for High School Chemistry Calorimetry Lab Gizmo : Lesson Info : ExploreLearning

	• Explain the relationship between equilibrium and changes of state. • Describe the structure of water and calculate the amount of energy absorbed or released when a quantity of water changes state. • Analyze a heating curve with calculations for enthalpy of formation and enthalpy of fusion. Reaction Energy: • Perform specific heat calculations. • Explain enthalpy change, enthalpy of reaction, enthalpy of formation, and enthalpy of combustion. • Solve thermodynamic problems. • Explain the relationship between enthalpy, entropy, and free energy and the tendency of a reaction to occur. • Discuss the concept of free energy, and explain how the value of this quantity is			

	calculated and interpreted.			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.3A.7 - Analyze and interpret data to determine the empirical formula of a compound and the percent composition of a compound	H.C.1A.5 - Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for models and investigations, and (3) use grade-level appropriate statistics to analyze data.
H.C.6A.3 - Plan and conduct controlled scientific investigations to produce mathematical evidence that mass is conserved in chemical reactions.	H.C.1A.6 - Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagram
H.C.6A.4 - Use mathematical and computational thinking to predict the amounts of reactants required and products produced in specific chemical reactions.	

Unit 7: The Mole/Stoichiometry
Unit Focus: Students Learn how to mathematically relate and calculate chemical reaction quantities based on the concept of the mole.

Standards	Sequenced Objectives	Scope	Content-Location	Resources
HC3A7 HC6A3 HC6A4 HC1A5 HC1A6	I can : ● Write and read numbers in scientific notation. ● Complete math problems using numbers in scientific notation. ● Complete dimensional analysis problems for converting units. What is a Mole? ● Recall that a mole is 6.022x1023 of any unit (called a	10 Days	Prentice Hall Chemistry 2008	Lab Determination of Percent by Mass of NaHCO3 One Reaction Lab Activities Stoichiometry Gizmo : ExploreLearning Stoichiometry Practice Worksheet Stoichiometry and Chemical Formula

	representative particle). ● Define the molar mass of a pure substance as the mass in grams of one mole of the substance ● Given a periodic table and an ionic formula, students will be able to calculate the formula mass. ● Given a periodic table and a covalent formula, calculate the molecular mass. ● Understand the similarity in the process of calculating molar mass, formula mass, and molecular mass. Calculations with the Mole: ● If given the mass in grams of any substance, determine how many moles. ● If given moles of any substance, determine the mass (grams).Using Ratios and Conversion Factors for Calculations: ● Understand and determine the mole ratio of any			

	substances in a chemical equation. ● Recognize that the stoichiometric mole ratios are based on number of particles and NOT mass. ● When given moles, liters, grams, or particles of any substance in a chemical equation, determine the moles, liters, grams, or particles of any other substance. Practical Uses of Stoichiometry ● Define “limiting reactant/reagent”. ● Define “Excess reactant/reagent”. ● Given reactant quantities, determine the limiting and excess reactant. ● Given reactant quantities, determine how much of the excess reactant will be leftover. ● Given reactant quantities, determine how much product can be produced. Solve complex multi-stepped stoichiometric problems given from			

	equations in word form only. ● Define theoretical yield and experimental yield. ● Use values of theoretical yield (given or calculated) and experimented (given or obtained via experimentation) to calculate the percent yield.			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

Semester Two

South Carolina College-and Career-Ready Standards	
H.C.1A.5 - Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for models and investigations, and (3) use grade-level appropriate statistics to analyze data.	H.C.1A.6 - Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagram

Unit 7: The Mole/Stoichiometry

Unit Focus: Students Learn how to mathematically relate and calculate more chemical quantities based on the concept of the mole. Students will continue to apply multiple objectives as addressed in part 1 of this unit in order to solve problems, but specific attention will focus on part 2 objectives.

Standards	Sequenced Objectives	Scope	Content-Location	Resources
HC1A5 HC1A6	I can : ● Calculate the percent composition (by mass) of any chemical compound. ● When given the number of atoms of an element, calculate the number of moles. ● Define empirical formulas, and explain how the term applies to ionic and molecular compounds. ● Determine the empirical formula from either a percentage or mass composition. ● Explain the relationship between	5 days	Prentice Hall Chemistry 2008	Determination of Percent by Mass of NaHCO3 Stoichiometry Gizmo : ExploreLearning

	the empirical formula and the molecular formula of a given compound. ● Determine a molecular formula from an empirical formula. ● Perform complex stoichiometric problems involving multiple step calculations.			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.4A.3 - Conduct controlled scientific investigations and use models to explain the behaviors of gasses (including the proportional relationships among pressure, volume, and temperature	H.C.1A.7 - Construct and analyze scientific arguments to support claims, explanations, or designs using evidence and valid reasoning from observations, data, or informational texts.
H.C.1A.3 - Plan and conduct controlled scientific investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses based on credible scientific information, (2) identify materials, procedures, and variables, (3) use appropriate laboratory equipment, technology, and techniques to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.	H.C.6A.2 - Use Le Chatelier's principle to predict shifts in chemical equilibria resulting from changes in concentration, pressure, and temperature.

Unit 8: Gas Laws Unit Focus: Students further investigate properties of matter focusing heavily on gasses and the mathematical relationships that define gasses.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
H.C.4A.3 H.C.1A.3 H.C.1A.7 HC6A2	I can : ● State the kinetic molecular theory of matter, and describe how it explains certain properties of matter. ● Explain the assumptions made about gasses based on the kinetic molecular theory. ● Define the terms ideal and real gas ● Describe the conditions under	5 Days	Prentice Hall Chemistry 2008	Gas Laws Worksheet Gas Properties - Virtual Lab Gas Law Labs or Demos.docx Lechat Shifts Which way will the Equilibrium Shift? (Le Chatelier's Principle)

	which a real gas deviates from "ideal" behavior. Pressure: ● Define pressure and describe how it is measured. ● State the standard conditions of temperature and pressure. ● Convert units of pressure. ● Use Dalton's law of partial pressures to calculate partial and total pressures. Gas Laws: ● Use the kinetic molecular theory to explain the relationships between gas volume, pressure, and temperature. ● Use Boyle's law to calculate volume-pressure changes at constant temperature. ● Use Charles's law to calculate volume temperature changes at constant pressure. ● Use Gay-Lussac's law to calculate pressuretemperature changes at a constant volume.			

	• Use the combined gas law to calculate volume temperature-pressure changes. • Define standard molar volume of gas and use it to calculate masses and volumes. • Using the ideal gas law, calculate pressure, volume, temperature, or amount of gas when the other three quantities are known. • Describe the process of diffusion and effusion. • State the relationship between the average molecular velocities of two gasses and their molar mass. • Follow Le Chatelier's Principle to predict chemical reaction shifts based on pressure temperature and concentration changes			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.5A.1 - Obtain and communicate information to describe how a substance can dissolve in water by dissociation, dispersion, or ionization and how intermolecular forces affect solvation.	H.C.1A.2 - Develop, use, and refine models to understand or represent phenomena, processes and relationships, test devices or solutions, or communicate ideas to others
H.C.5A.2 - Analyze and interpret data to explain the effects of temperature and pressure on the solubility of solutes in a given amount of solvent.	H.C.1A.5 - Use mathematical and computational thinking to use and manipulate appropriate metric units, express relationships between variables for models and investigations and use grade level appropriate statistics to analyze data.
H.C.5A.3 - Use mathematical representations to analyze the concentrations of unknown solutions in terms of molarity and percent by mass.	

Unit 9: Solutions Unit Focus: Students learn factors that affect solutions and their solubility, and how to calculate these concentrations.				
Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC5A1 HC5A2 HC5A3 HC1A2 HC1A5	I can : ● Explain the effects of temperature on solubility of solids in a liquid. ● Explain the effects of temperature and pressure on solubility of a gas in a liquid. ● Describe and explain saturated, unsaturated, and supersaturated solutions. ● Use a solubility curve or table to determine if a given solution is saturated, unsaturated,	5 Days	Prentice Hall Chemistry 2008	Solubility of KNO3 Lab Make Various Molar Solutions ● Begin with CuCl ● Compare students calculations as well as color comparisons ● Visually see if concentrations are being done correctly Solutions and Solubility

	or supersaturated at a given temperature. Molarity and Concentration: ● Define molarity. ● Perform calculations with molarity. Recall that if grams of solute are given, it must be converted to moles for molarity calculations. ● Calculate percent by mass of solutions. ● Use M1V1 = M2V2 to perform dilution calculations.			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.5A.4 - Analyze and interpret data to describe the properties of acids, bases, and salts.	H.C.1A.2 - Develop, use, and refine models to understand or represent phenomena, processes and relationships, test devices or solutions, or communicate ideas to others.
H.C.1A.5 - Use mathematical and computational thinking to use and manipulate appropriate metric units, express relationships between variables for models and investigations and use grade level appropriate statistics to analyze data.	

Unit 10: Acids and Bases
Unit Focus: Students learn the difference between acid and bases and how to calculate values relating to them.

Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC5A4 HC1A5 HC1A2	I can : ● Differentiate between Arrhenius, Bronsted Lowry, and Lewis definitions of Acids and Bases. ● Recognize that the strength or weakness of an acid or base is determined by the degree to which it ionizes. ● Identify the acid, base, salt, and water in a neutralization reaction. ● Describe the properties of acids and bases.	7 Days	Prentice Hall Chemistry 2008	Lab: The Ups and Downs of PH Into to AB POGIL.pdf Titration Gizmo : Lesson Info : ExploreLearning

	● Understand and interpret a pH scale. ● Calculate pH and pOH if given concentration. ● Calculate concentration if given pH or pOH. ● Use Kw to understand the autoionization of water and how to determine pH or pOH given concentrations. ● Calculate % ionizations based on acid/base strength ● Complete titration stoichiometry and demonstrate titration procedures in lab. ● Connect Solution chemistry - molarity to Acids and bases			

Subject: Chemistry Honors

Teacher Curriculum Guide

Based on 90 Minutes of Daily Instruction

South Carolina College-and Career-Ready Standards	
H.C.2B.1 - Obtain and communicate information to compare alpha, beta, and gamma radiation in terms of mass, charge, penetrating power, and their practical applications (including medical benefits and associated risks).	H.C.2B.4 - Use mathematical and computational thinking to explain the relationship between mass and energy in nuclear reactions (E = mc2).
H.C.2B.2 - Develop models to exemplify radioactive decay and use the models to explain the concept of half-life and its use in determining the age of materials (such as radiocarbon dating or the use of radioisotopes to date rocks).	H.C.6A.1 - Develop and use models to predict the products of chemical reactions (1) based upon movements of ions; (2) based upon movements of protons; (3) based upon movements of electrons
H.C.2B.3 - Obtain and communicate information to compare and contrast nuclear fission and nuclear fusion and to explain why the ability to produce low energy nuclear reactions would be a scientific breakthrough.	

Unit 11: Nuclear Chemistry
Unit Focus: Students learn the different types of nuclear decay from radioactivity and half life calculations.

Standards	**Sequenced Objectives**	**Scope**	**Content-Location**	**Resources**
HC2B1 HC2B2 HC2B3 HC2B4 HC6A1	I can: ● Understand and work the following: ● Explain how decay rate is characteristic to an isotope. ● Perform calculations involving half-life and represent the concept of half-lives with a diagram. ● Understand how half-life of radioisotopes can be used to determine the age of materials.	Days 3-4 days	Prentice Hall Chemistry 2008	Nuclear Energy PowerPoint- fission -fusion Nuclear Chemistry: Identify alpha, beta, gamma, or neutron.

	● Recognize the symbol for alpha, beta and gamma radiation. ● Explain the nature of each type of radiation including mass and charge. ● Compare the penetrating power of alpha, beta, and gamma particles and give examples of what will block each. ● Describe the effect of the release of the particles from the nucleus for each particle. ● Understand practical applications of radiation (including medical benefits and associated risks). Nuclear Fission and Nuclear Fusion ● Illustrate the process of nuclear fission in words and/or with a diagram. ● Illustrate the process of nuclear fusion in words and/or with a diagram. ● Understand and calculate the relationship between mass and energy in nuclear reactions			

	using Einstein's equation E=mc2. ● Differentiate the energy from fusion reactions, fission reactions, and chemical reactions in terms of reaction temperature and energy released per kg of fuel. ● Explain why low energy nuclear reactions would be a scientific breakthrough. ● Identify typical inputs for fission and fusion reactions. ● Write and balance equations for fission and fusion reactions.			