Chemistry I Curriculum Guide

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Introduction

Introduction

The primary objective of the Chemistry course will be to produce a scientifically literate student who will have a working knowledge of chemistry and recognize the crucial role it plays in everyday life. Its main goal is to make science understandable through careful concept development, laboratory experiments, hands-on demonstrations, and problem solving strategies. The students will be encouraged to think logically, make observations, analyze information, and develop creativity. Chemistry is a challenging course designed for the student who has successfully mastered the mathematical concepts required for this course.

The evaluation of the learner will be a comprehensive assessment of critical thinking skills. These assessments will be based on objective and essay tests, oral presentations, and student performance. Many topics can be evaluated in several different ways. However, the emphasis will be on critical thinking and higher order cognitive skills rather than simple memorization of facts. Students will be given the opportunity to merge chemical concepts with laboratory experimentation.

The following abbreviations are used throughout this document:

LM—Lab Manual
SSLM—Small Scale Lab Manual
TE—Teacher's Edition
SE—Student's Edition

The Philosophy of Chemistry

Chemistry is designed to accentuate the thought processes and enhance the scientific competency of each student enrolled. The course work is designed to utilize and magnify cognitive abilities through laboratory experiences that emphasize problem solving and decision-making. It is also crafted to examine the nature of scientific enterprise, the relationship of science and society, and the integration of science, technology, and mathematics.

Rationale

This course is designed to challenge and strengthen the critical thinking skills of students. It is a focused study that meets the state Chemistry standards and future end-of-course testing requirements. The evaluation of the course will be based on assessments that target critical thinking and examine how the student is able to apply scientific principles.

Modifications for IEP

The students within Shelby County Schools who require modifications due to their Individualized Education Program (IEP) are legally entitled to curriculum adjustment. An IEP is a legal document which must be followed in accordance with the laws set forth by the federal government, state statutes and Shelby County Schools' policy.

All educators must examine the student's IEP to determine exactly what modifications are necessary to meet the student's educational needs. For example, many IEPs require extended time for student reading, writing, test taking, and other assignments. However, it is not a question of whether the IEP should be followed, rather, it is a question of how best to effectively implement the required modifications of the IEP to benefit the student. Educators should read each student's IEP and review curriculum plans. Interviewing the students individually provides and excellent means of finding techniques to maximize the student's educational progress. School resource departments are also invaluable resources.

Below are a few examples of modifications that can be used not only for science, but also across the curriculum:

Assignment Sheets

Refer to figure 1.2 for an example of an assignment sheet. An assignment sheet is an extremely effective modification tool. It allows students to take responsibility for their assignments. The assignment number is placed on each appropriate assignment. This modification is also effective and important for non-resource students.

Testing Modifications

Testing modifications requires the educator to alter testing procedures to fit specific individual needs. This modification does not have to be a major reformatting of the testing procedure. One example is to utilize a matching or visual answer format. Some IEPs require reduced items or reduce the number of choices on multiple-choice questions. Changing a testing format does not necessarily suggest that an essay test be transformed into a multiple-choice test. Providing a list of concepts with the question is one type of modification. Students can choose from a list and explain it in their own words. Giving an individual more information to assist guiding the train of thought is also helpful. Adding a few matching or visual items to the questions can accomplish this. The number of questions of questions does not necessarily need to vary. The modified tests can virtually be the same in content,

Figure 1.2: Example copy of an assignment sheet

Assignment Sheet: Biology

Name: Period:

Assign. #	Assignment Title	Date Assigned/Date Due
1	The Plant Cell	08/07/03 / 08/12/03
2	The Animal Cell	O8/10/03 / 08/17/03
3		

Possible Modifications for IEPs

Regular Program Participation

Classroom Accommodations/Modifications:

___ Preferential seating
___ Provide copies of material to be copied from book or board
___ Provide copies of notes (from another student)
___ Peer tutoring
___ Behavior/performance contracting
___ Acknowledge effort put forth
___ Allow limited movement within classroom
___ Other:_____

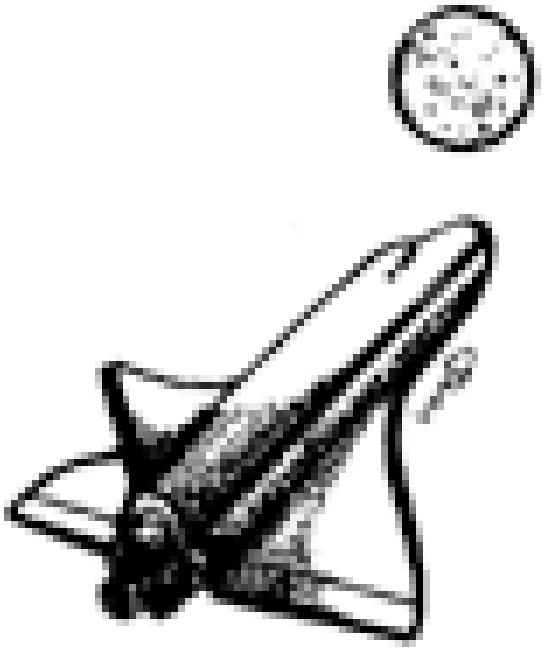
Assignment Accommodations/Modifications:

___ Assignment book
___ Abbreviated assignments or reduced number of assignments
___ Study guide
___ Cursive/manuscript handwriting
___ Extra grade opportunities (Redo items missed, extra credit)
___ Compacting
___ Grade on effort/individual ability in addition to test scores
___ Extended time
___ Other:_____

Classroom Testing Accommodations/Modifications:

___ Extended time
___ Directions/test to be read for the student
___ Use of calculator
___ Word processor
___ Modify grading scale
___ Oral testing
___ Modify test format
___ Abbreviated concepts tested
___ Reduce test items per page
___ Allow tests to be taken in special education setting
___ Other:_____

Tennessee State Standards



Standards

Chemistry I Standards

Course Description: Chemistry is a course that explores the properties of substances and the changes that substances undergo. The student will investigate the following:

- Atomic Structure
- Matter and Energy
- Interactions of Matter
- Properties of Solutions and Acids and Bases

Students should explore chemistry through inquiry, hands-on laboratory investigations, individual studies, and group activities. The students' experiences in chemistry should enable them to understand the role of chemistry in their lives by investigating substances that occur in nature, in living organisms, and those that are created by humans. Their study should include both qualitative and quantitative descriptions of matter and the changes that matter undergoes. Students should practice the necessary precautions for performing safe inquiries and activities and appreciate the risks and benefits of producing and using chemical substances.

Standard Number: 1.0 Atomic Structure

Standard: The student will investigate atomic structure and how this determines the physical and chemical properties of matter.

Learning Expectations:

The student will

- 1.1 compare and contrast various models of the atom as they emerged historically, from the Greeks to the modern electron-cloud model.
- 1.2 investigate the basic organization of the modern periodic table, including atomic number and atomic properties.
- 1.3 describe models of the atom in terms of orbital, electron configuration, orbital notation, quantum numbers, and electron-dot structures.
- 1.4 investigate the composition of the nucleus so as to explain isotopes and nuclear reactions.
- 1.5 relate the spectral lines of an atom's emission spectrum to the transition of electrons between different energy levels within an atom.

Performance Indicators:

at Level 1, the student is able to

- categorize an element as a metal, metalloid, nonmetal, or noble gas based on its position in the periodic table.
- identify an element's atomic number and name or symbol, given the number of protons or electrons in a neutral atom using a periodic table.
- identify protons, neutrons and electrons with regard to their relative mass, relative charge, and location in an atom.

At Level 2, the student is able to

- identify the major characteristics of various models of the atom: Democritus, Thomson, Rutherford, Bohr, and the modern quantum mechanical model.
- determine the number of protons, neutrons, and electrons in an atom or ion, given the symbol of the atom or ion and a periodic table.
- compare s and p orbitals in an energy level in terms of general shape, energy and/or numbers of electrons possible.

- determine the Lewis electron-dot structure or number of valence electrons for an atom of any main group element (1, 2, 13-18), given its atomic number or
- its position in the periodic table.

At Level 3, the student is able to

- describe the trends present in the periodic table with respect to atomic size, ionization energy, electron affinity or electronegativity.

Performance Indicators Teachers:

at Level 1, the student is able to

- identify an isotope when given the number of protons and neutrons.
- draw Bohr models for the first 18 elements.

At Level 2, the student is able to

- write the arrangement of electrons by orbital notation, electron configuration notation, and electron-dot notation.
- predict the charge of an ion usually formed by the main-group elements (1, 2, 13-18) using the periodic table.
- organize atoms from the main- group elements (1, 2, 13-18) based on atomic radii.
- support the existence of the atom using the laws of definite composition, conservation of matter, and multiple proportions.
- calculate the average atomic mass of an element from the percent distribution and masses of isotopes.
- explain the formation of anions and cations.
- use the Bohr model to draw an electron moving from its ground state to an excited state, and/or represent the emission of energy as it returns from an excited state to a lower energy state.
- recognize names of famous scientists and identify their major contributions: Neils Bohr, James Chadwick, John Dalton, Max Planck, Ernest Rutherford, J.J. Thomson.
- describe the differences between the Bohr model of the atom and the quantum mechanical (QM) electron-cloud model of the atom.
- calculate wavelength, frequency or energy of a photon of electromagnetic radiation, given the formula and constants.
- research careers that relate to atomic structure, such as astronomy, nuclear medical technician, research physicist, chemist, etc.

at Level 3, the student is able to

- compare s, p, d, and f orbitals in an energy level in terms of general shape, energy or number of electrons possible.
- determine quantum numbers for elements given the electron configuration.
- explain in a paragraph why some elements do not have the predicted electron configuration; for example, copper tends to have an electron configuration of [Ar] 4s13d10 instead of [Ar] 4s23d9.
- justify the quark combinations that make protons and neutrons, given the charges of the up and down quarks.
- write the nuclear equation involving alpha or beta particles, given the mass number of the parent isotope and complete symbols for alpha or beta emissions.

Sample Task: Flame Test Demonstration

Standard Number: 2.0 Matter and Energy

Standard: The student will investigate the characteristics of matter and the interaction of matter and energy.

Learning Expectations:

The student will
2.1 investigate the characteristics of matter.
2.2 explore the interactions of matter and energy.
Performance Indicators:
at Level 1, the student is able to

- identify a pure substance as element or compound, when given its chemical name or formula.
- distinguish among elements, compounds, solutions, colloids, and suspensions, given examples.
- classify changes in matter as physical or chemical, given examples or scenarios.
- classify properties of matter as physical or chemical when given examples or scenarios.
- distinguish between heat content and temperature when given a unit, a definition, or an example.

At Level 2, the student is able to

- distinguish among gases, liquids, and solids in terms of particle spacing and relative movement, given a diagram or scenario.
- predict the effect of changing one gas variable (volume, temperature, or pressure) on another variable, given a scenario.
- demonstrate an understanding of the law of conservation of matter, given experimental data.
- categorize a process as endothermic or exothermic, given an example or scenario.

At Level 3, the student is able to

- demonstrate an understanding of the law of conservation of energy by equating heat loss and heat gain in an interaction, given the formulas –q = q volume and time. The students can use various liquids, i.e. water, alcohol, oils, etc. Suggestions for analysis involves graphing (bar graphing/liner graphing) various

Performance Indicators Teacher:
at Level 1, the student is able to

- estimate equivalent Fahrenheit and Celsius temperatures and convert between Celsius and Kelvin temperature scales.
- measure the mass and volume of solids and liquids using appropriate equipment, methods, and units
- determine the density of solids and liquids.
- read a thermometer and determine the temperature accurately.
- at Level 2, the student is able to
- distinguish between accuracy and precision.
- create data tables and graphs from experimental data.
- analyze data by computing a percentage error.
- record measurements and results of calculations using the correct number of significant figures.
- characterize a relationship between two variables as directly or inversely proportional.
- use conversion factors, dimensional analysis, and ratio and proportion to convert between quantities.
- express large and small numbers using scientific notation and perform calculations in scientific notation.
- practice appropriate safety procedures when working in the laboratory.
- research careers that relate to matter and energy such as, surveyor, carpenter, structural engineer, HVAC technician, pathologist, etc.

at Level 3, the student is able to

- identify an unknown metal by determining its specific heat, using a calorimeter.

Sample Task:
Bell, Jerry. “Mystery Powders: An Inquiry Activity.” Chemistry in the National

Science Education Standards. Chapter 5. Students are given samples of seven white powders, each of which is a common household substance, and five test reagents. They are to develop a procedure to distinguish among the powders based on their physical and chemical properties, and to identify each powder when given a chart of expected results. The seven white solids are baking powder, baking soda, sugar, flour, sugar substitute, washing soda, and calcium supplement. The test reagents are water, phenolphthalein (or pH test paper), vinegar, iodine solution and alcohol.

Standard Number: 3.0 Interactions of Matter

Standard: The student will examine the interactions of matter.

Learning Expectations:

The student will

- 3.1 investigate chemical bonding.
- 3.2 analyze chemical reactions.
- 3.3 apply the mathematics of chemical formulas and equations.

Performance Indicators:

at Level 1, the student is able to

- distinguish between a chemical symbol and a chemical formula, given examples.
- identify the reactants and products in a chemical reaction, given a balanced chemical equation.
- explain the differences among the composition, decomposition, double replacement, and single replacement types of chemical reactions, given a balanced equation.
- determine the number of atoms, formula units, or molecules of a particular substance, given a balanced equation.

At Level 2, the student is able to

- distinguish between ionic and covalent compounds, given binary formulas.
- identify the formula for a compound using a periodic table and a list of common ions, given the name of the compound.
- identify the name of compounds and common acids (sulfuric acid, nitric acid, hydrochloric acid, acetic acid, and phosphoric acid), using a periodic table and a list of common ions.
- select a correctly balanced chemical equation, when given examples.
- recognize a balanced chemical equation using appropriate symbols, given a word equation.
- convert between any two of the following quantities of a substance:

mass
number of moles
number of particles
molar volume (at STP)

- determine molar ratios expressed in balanced chemical equations.
- analyze percent composition of the elements in a compound, given the formula.
- solve mass-to-mass stoichiometry problems.

At Level 3, the student is able to

- identify and solve different types of stoichiometry problems.

Performance Indicators Teacher:

at Level 1, the student is able to

- write a balanced equation and identify the reactants and products.

At Level 2, the student is able to

- draw models of atoms that are bonded ionically and covalently.
- write the formulas for compounds, given the names of compounds.
- write the names of compounds, given examples of chemical formulas using the stock system.

- write a balanced chemical equation and classify as to type, given a word description of a chemical reaction.
- calculate and measure the actual molar mass of a substance and relate it to the number of particles.
- predict the products of a single or double replacement chemical reaction, given an activity series and a solubility chart.
- research careers that relate to interactions of matter, such as pharmacist technician, industrial chemist, chemical technician, chemical engineer, etc.

at Level 3, the student is able to

- draw shapes of molecules and label bond angles, bond polarity, and molecule polarity, given a formula.
- predict amounts of product given mole or mass amounts of reactants in an experiment and compare actual yield to theoretical yield.
- use percentage composition to determine the empirical or molecular formula of an unknown substance.

Sample Task:

1.Using molecular model kits, have students construct shapes of various molecules.
2.Using marshmallows or gumdrops and toothpicks, have students construct elements and compounds involved in a balanced chemical equation.
3.Direct students to calculate the molar mass of a substance and measure that amount into a sealable plastic bag to demonstrate mole amounts.
4.Have students make a model of the molar volume of a gas using balloons or boxes.

Standard Number: 4.0 Solutions and Acids/Bases

Standard: The student will investigate the characteristics of solutions with particular attention to acids and bases.

Learning Expectations:

The student will

- 4.1 investigate the characteristics of solutions.
- 4.2 investigate the characteristics of acids and bases.

Performance Indicators:

at Level 1, the student is able to

- classify substances as acids or bases, given the formula.

At Level 2, the student is able to

- identify the solute and solvent in a solid, liquid or gaseous solution, given its composition.
- classify a solution as saturated, unsaturated, or supersaturated, given the composition of the solution and a solubility graph.
- calculate the concentration of a solution in terms of molarity or mass percent, given mass of solute, and mass or volume of solution.
- classify a substance as an acid or a base, given its properties (e.g., color of litmus, color of phenolphthalein, taste, pH and slippery or non-slippery).

At Level 3, the student is able to

- predict the products of a neutralization reaction involving inorganic acids and bases, given the reactants.

Performance Indicators Teacher:

at Level 1, the student is able to

- demonstrate the factors (temperature, stirring, particle size and concentration) that affect the rate at which a solute dissolves.

- determine the acidity/basicity of substances by observing their effect on various indicators.

At Level 2, the student is able to

- describe how to prepare a dilute solution from a concentrated solution of known molarity.
- perform a neutralization reaction.
- research careers that relate to solutions, such as cosmetologist, environmental scientist, water quality control technician, artist, etc.

at Level 3, the student is able to

- investigate colligative properties, i.e. the effect on freezing point and boiling point when a solute is added to a solvent.
- demonstrate knowledge of neutralization reactions by performing a titration.
- calculate the molality of solutions.
- classify a solution as neutral, acidic, or basic, and calculate the pH, given the hydrogen ion concentration or hydroxide ion concentration.

Sample Task:

Students will classify various household substances as acid or base using various natural and synthetic indicators.

Course Outline

Course Outline

First Nine Weeks

I. Matter and Change
   A. Lab Safety
   B. Scientific Method
   C. Classification of Matter
   D. Physical and Chemical Properties of Matter
   E. Physical and Chemical changes
   F. Chemical Symbols
   G. Characterization of States of Matter

II. Scientific Measurement
   A. Accuracy and Precision
   B. Scientific Notation
   C. Significant Figures
   D. SI system
   E. Temperature Scales and Conversions

III. Problem Solving
   A. Conversion Factors
   B. Dimensional Analysis

IV. Atomic Structure
   A. Discovery of subatomic particles and basic atomic structure
   B. Relative mass and charges of subatomic particles
   C. Calculating numbers of subatomic particles in neutral atoms, ions, and isotopes
   D. Calculating atomic masses from isotope data
   E. Atomic models

V. Electrons in Atoms
   A. Energy levels and orbitals
   B. Electron Configurations
   C. Light and the Atomic Spectra

VI. Periodic Table
   A. Development
   B. Families and Periods
   C. Patterns in Electron Configurations
   D. Trends in Atomic and Ionic Radii, Ionization Energy, and Electronegativity

Second Nine Weeks

I. Ionic and Covalent Bonds
   A. Valence Electrons/Electron Dot Structures
   B. Formation and Properties of Ionic and Covalent Bonds
   C. VSEPR Theory
   D. Bond Polarity
   E. Intermolecular Attractions

II. Chemical Names and Formulas
   A. Binary Molecular Compounds
   B. Binary Ionic Compounds
   C. Ternary Ionic Compounds
   D. Acids

III. Molar Relationships
   A. The Mole
   B. Molar Mass/Molar Volume
   C. Percent Composition
   D. Molecular and Empirical Formulas

IV. Chemical Reactions and Equations
   A. Writing Chemical Equations
   B. Balancing Chemical Equations
   C. Types of Chemical Reactions
   D. Predicting Products of Reactions

Third Nine Weeks

I. Stoichiometry
   A. Stoichiometric Calculations
   B. Limiting and Excess Reactants
   C. Percent Yield

II. States of Matter
   A. Properties of Solids, Liquids, and Gases
   B. Kinetic Theory
   C. Phase Changes/Diagrams

III. Behavior of Gases
   A. Gas Law Relationships
   B. Gas Law Calculations

IV. Properties of Solutions
   A. Solubility
   B. Molarity/Molality
   C. Making Dilutions

Fourth Nine Weeks

I. Reaction Rates and Equilibrium
   A. Factors Affecting Reaction Rates
   B. Reversible Reactions

II. Acids and Bases
   A. Properties of Acids and Bases
   B. Calculating pH and pOH
   C. Neutralization Reactions
   D. Titration

III. Thermochemistry
   A. Specific Heat Capacity
   B. Endothermic and Exothermic Processes
   C. Calorimetry
   D. Heats of Reaction

IV. Hydrocarbon Compounds
   A. Naming and drawing hydrocarbons

First Nine Weeks Outline

I. Introduction to Chemistry / Matter and Change
   A. Discuss and practice laboratory safety procedures.
   B. Solve problems using the scientific method.
   C. Display laboratory data using tables and graphs.
   D. Classify a sample of matter as a pure substance (element/compound) or a mixture (heterogeneous/homogeneous)
   E. Differentiate between physical and chemical properties of matter.
   F. Identify changes in matter as physical or chemical.
   G. Identify the chemical symbols of common elements, and name common elements, given their symbol.
   H. Differentiate among the states of matter.

II. Scientific Measurement
   A. Distinguish among the accuracy, precision, and error of a measurement.
   B. Convert measurements to scientific notation.
   C. Identify the number of significant figures in a measurement and in the result of a calculation.
   D. Make measurements using the SI system.
   E. Calculate the density of an object from experimental data.
   F. Convert between the Fahrenheit, Celsius, and Kelvin temperature scales.

III. Problem Solving
   A. Construct conversion factors from equivalent measurements.
   B. Make conversions within the metric system and solve problems using dimensional analysis.

IV. Atomic Structure
   A. Distinguish among protons, electrons, and neutrons in terms of relative mass and charge.
   B. Describe the structure of an atom, including the location of the subatomic particles with respect to the nucleus.
   C. Calculate the numbers of protons, neutrons, and electrons in neutral atoms, ions, and isotopes.
   D. Explain how isotopes differ and why the atomic masses of elements are not whole numbers.
   E. Calculate the average atomic mass of an element from isotope data.

V. Electrons in Atoms
   A. Describe the significance of various atomic models,
   B. Distinguish between principle energy levels, sublevels, and orbitals. Apply the Aufbau principle, the Pauli exclusion principle, and Hund's rule in writing electron configurations of elements.
   C. Explain the origin of the atomic emission spectrum of an element.

VI. Periodic Table
   A. Explain why you can infer the properties of an element based on those of other elements in
      i. the periodic table.
   B. Use electron configurations to classify elements as noble gases, representative elements, transition metals, or inner transition metals.

C. Interpret group trends in atomic radii, ionic radii, ionization energies, and electronegativities.
D. Interpret period trends in atomic radii, ionic radii, ionization energies, and electronegativites.

Second Nine Weeks Outline

I. Ionic and Covalent Bonds
   A. Use the periodic table to infer the number of valence electrons in an atom and draw its electron dot structure.
   B. Describe the formation of cations from metals and anions from nonmetals.
   C. List the characteristics of an ionic compound.
   D. Use electron dot structures to show the formation of single, double, and triple covalent bonds.
   E. List the properties of a covalent compound.
   F. Use VSEPR theory to predict the shapes of single covalently bonded molecules.
   G. Use electronegativity values to classify a bond as nonpolar covalent, polar covalent, or ionic.
   H. Name and describe the weak attractive forces that hold groups of molecules together.

II. Chemical Names and Formulas
   A. Apply the rules for naming and writing formulas for binary molecular compounds.
   B. Apply the rules for naming and writing formulas for binary ionic compounds.
   C. Apply the rules for naming and writing formulas form ternary ionic compounds.
   D. Name and write formulas for common acids.

III. Molar Relationships
   A. Describe how Avogadro's number is related to a mole of any substance.
   B. Calculate the mass of a mole of any substance.
   C. Use the molar mass to convert between mass and moles of a substance.
   D. Use the mole to convert among measurements of mass, volume, and number of particles.
   E. Calculate the percent composition of a substance from its chemical formulas or experimental data.
   F. Derive the empirical formula and the molecular formula and the molecular formula of a compound from experimental data.

IV. Chemical Reactions and Equations
   A. Write equations describing chemical reactions using appropriate symbols.
   B. Write balanced chemical equations when given the names or formulas of the reactants and products in a chemical reaction.
   C. Identify a reaction as combination, decomposition, single-replacement, double-replacement, or combustion.
   D. Predict the products of combination, decomposition, single-replacement, double-replacement, and combustion reactions.

Third Nine Weeks Outline

I. Stoichiometry
   A. Construct mole ratios from balanced chemical equations and apply these ratios in mole-mole stoichiometric calculations.
   B. Calculate stoichiometric quantities from balanced chemical equations using units of moles, mass, representative particles, and volumes of gases at STP.
   C. Identify and use the limiting reagent in a reaction to calculate the maximum amount of product(s) produced.
   D. Calculate theoretical yield, actual yield, or percent yield given appropriate information.

II. State of Matter
   A. Describe the motion of gas particles according to the kinetic theory.
   B. Interpret gas pressure in terms of kinetic theory.
   C. Describe the nature of a liquid in terms of the attractive forces between the particles.
   D. Differentiate between evaporation and boiling of a liquid, using kinetic theory.
   E. Describe how the degree of organization of particles distinguishes solids from gases and liquids.
   F. Interpret the phase diagrams of water at any given temperature and pressure.

III. Behavior of Gases
   A. Explain how the kinetic energy of gas particles relates to Kelvin temperature.
   B. Explain how changing factors such as temperature and volume of a container affect gas pressure.
   C. State Boyle's Low, Charles's Law, Gay-Lussac's Law, the Combined Gas Law, Dalton's Law, Ideal Gas Law, and Graham's Law.
   D. Apply gas laws to problems.

IV. Properties of Solutions
   A. Identify the factors that determine the rate at which a solute dissolves.
   B. Calculate the solubility of a gas in a liquid under various pressure conditions.
   C. Solve problems involving the molarity of a solution.
   D. Describe how to prepare dilute solutions from more-concentrated solutions of known molarity.
   E. Calculate the molality and mole fraction of a solution.

Fourth Nine Weeks Outline

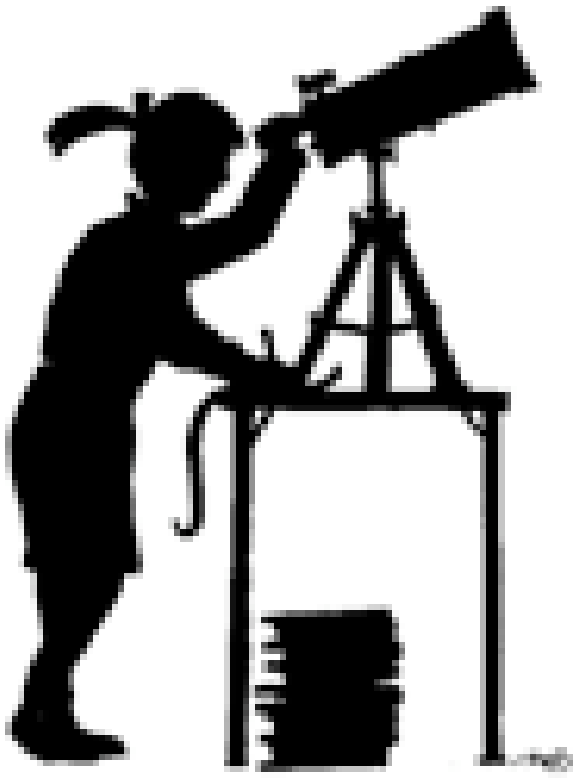
I. Reaction Rates and Equilibrium
   A. Explain what is meant by the rate of a chemical reaction.
   B. Using the collision theory, explain how the rate of a chemical reaction is influenced by the reaction conditions.

II. Acids and Bases
   A. List the properties of acids and bases.
   B. Given the hydrogen-ion or hydroxide-ion concentrations, classify a solution as neutral, acidic, or basic.
   C. Convert hydrogen-ion concentrations into values of pH and hydroxide-ion concentrations into values of pOH.
   D. Compare and contrast acids and bases as defined by the theories of Arrhenius, Bronsted-Lowry, and Lewis.
   E. Explain how acid-base titration is used to calculate the concentration of an acid or a base.
   F. Explain the concept of equivalence in neutralization reactions.

III. Thermochemistry
   A. Explain the relationship between energy and heat.
   B. Explain the concept of specific heat capacity.
   C. Construct equations that show the heat changes for chemical and physical processes.
   D. Calculate heat changes in chemical and physical processes.
   E. Calculate heat changes that occur during phase changes.

IV. Hydrocarbon Compounds
   A. Describe the bonding in hydrocarbons.
   B. Distinguish between straight-chain and branched-chain hydrocarbons.
   C. Given the structure, name alkanes, alkenes, and alkynes.
   D. Given the name, draw the structure of alkanes, alkenes, and alkynes.

Scope and Sequence



Nine Weeks: First

Standard 1.1-1.5, 2.1, 2.2

Unit	Chapter Topics	Laboratories / Activities	Demonstrations/ Technology
Matter and Change	Chapters 1 and 2 pp 2-49	Observing and Inferring (LM pp 21-24) A Study of Chemical Changes (SSLM pp 17-24) Minilab: Mixtures (SE/TE p. 35)	Invisible Messages TE p. 16 Iron Cereal TE p. 32 Separation of Sugar TE p. 36 Mixtures vs. Compounds TE p. 41 Identifying Chemical Changes TE p. 42
Scientific Measurement	Chapter 3 pp 50-81	Mass, Volume, and Density (LM pp 37-44) Measurement (SE/TE p. 73)	Water Displacement TE p. 69 Measuring Density TE p. 69
Problem Solving	Chapter 4 pp 82-105		Transferring Ice TE p. 83
Atomic Structure	Chapter 5 pp 106-131	Isotopes and Atomic Mass (LM pp 47-50) The Atomic Mass of Candium (SE/TE p 122)	Cathode Ray TE p. 110

Electrons in Atoms	Chapter 13 pp 360-389	Flame Tests for Metals (LM pp 151-154) Electron Configurations of Atoms and Ions (SE/TE p 371)	Music and Quantized Energy TE p. 362
Periodic Table	Chapter 14 pp 390-411	Periodic Properties (LM pp 165) Chemical Properties of the Halides (SE/TE p 397)	Electron Shielding TE p. 400 Chemical Reactivity and Ionization Energy TE p. 402 Electron Cloud TE p. 403

Nine Weeks: Second

Standards: 3.1-3.3

Unit	Chapter Topics	Laboratories / Activities	Demonstrations/ Technology
Ionic and Covalent Bonds	Chapters 15-16 pp 412-473	Crystal Structures (LM: pp 171-176) Molecular Models (LM: pp 177-182) Paper Chromatography (SSLM: pp 151-156)	Electrons and the Plastic Egg TE p. 414 "Minilab" SE/TE p. 425
Chemical Names and Formulas	Chapter 6 pp 132-169	Chemical Names and Formulas (LM: pp 51-57) Minilab: Making Ionic Compounds (SE/TE p. 163)	Molecular Models TE p. 134 Zinc Iodide TE p. 150 Precipitation TEp. 154
Molar Relationships	Chapter 7 pp 170-201	Weighing: A Means of Counting (SSLM: 59-62) Minilab: Percent Composition (SE/TE p. 195)	Moles of Different Substances TE p. 173
Chemical Reactions and Equations	Chapter 8 pp 202-235	Types of Chemical Reactions (LM: pp 85-91)	Chemical Change TE p. 205 Aluminum and Copper TE p. 208 Combination Reaction TE p. 213 Single Replacement Reaction TE p. 216 Double Replacement Reaction TE p. 217 Combustion Reaction TE p. 219

Nine Weeks: Third

Standard 2.1, 2.2, 3.3, 4.1

Unit	Chapter Topics	Laboratories / Activities	Demonstrations/ Technology
Stoichiometry	Chapter 9 pp. 236-275	Quantitative Analysis (LM pp 93-99) Analysis of Baking Soda (SE/TE p. 251) Balanced Chemical Equations (LM pp 101-106)	Lemonade Fizz TE p. 240 Magnesium Strip TE p. 241 Limiting Reagents TE p. 253
States of Matter	Chapter 10 pp. 266-291	Changes of Physical State (LM pp 107-114) Absorption of Water (SSLM pp. 93-96)	Observing Gas Pressure TE p. 268 Atmospheric Pressure TE p. 271 Crystalline Solid TE p. 281
Behavior of Gases	Chapter 12 pp. 326-359	Synthesis and Qualitative Analysis of Gases (SSLM pp. 103-109) Diffusion of Gases (LM pp. 147-150)	Changing Pressure TE p. 333 Bicycle Tire TE p. 338 Marble Gas Particles TE p. 343
Properties of Solutions	Chapter 18	Factors Affecting Solution Formation (LM pp. 205-210) Making a Solution (SE/TE p. 516)	Soda and Solubility of Gases TE p. 505 Serial Dilutions TE p. 514

Nine Weeks: Fourth

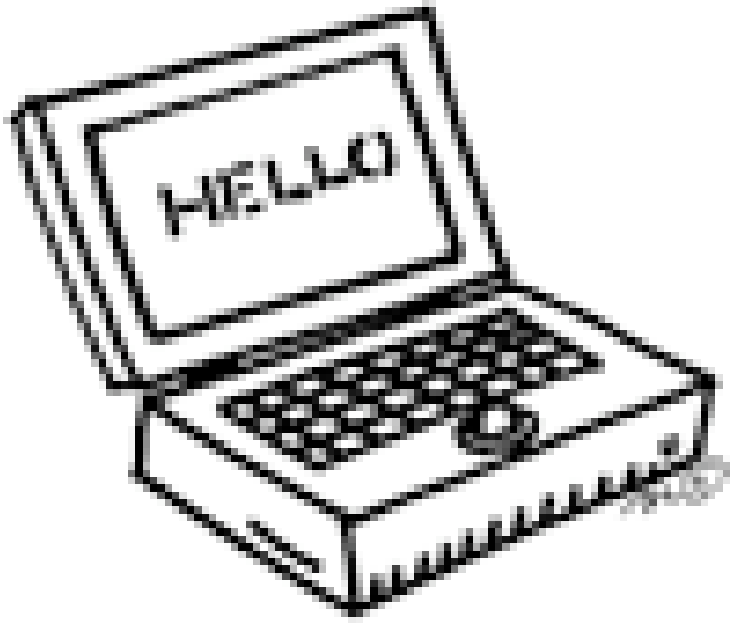
Standard: 2.2, 3.1, 4.1, 4.2

Unit	Chapter Topics	Laboratories / Activities	Demonstrations
Reaction Rates and Equilibrium	Chapter 19 pp. 532-575	Factors Affecting the Rate of a Chemical Reaction (SSLM pp. 173-178) The Clock Reaction (LM pp 235-241) Enthalpy and Entropy (SE/TE p 557)	Catalysts TE p. 536 Surface Area TE p. 537 Temperature and Equilibrium TE p. 545 Entropy TE p. 552 Spontaneous Reactions TE p. 562
Acids and Bases	Chapters 20-21 pp. 576-643	Estimation of pH (LM pp. 249-252) Strong and Weak Acids and Bases (SSLM pp. 201-208) Neutralization Reactions (LM pp. 257-260) Acids-Base Titrations (LM pp. 261-268) Buffers (SSLM pp 217-222)	Liberation of a Gas TE p. 577 pH of a Solution TE p. 581 Strong vs. Weak Acids TE p. 601 Neutralization TE p. 614 Titration TE p. 617 Dilutions TE p. 622 pH of Salt Solutions TE p. 627 Neutralizing Capacity TE p. 628
Thermochemistry	Chapter 11 pp. 292-325	Heat of Fusion of Ice (SSLM pp. 97-101) The Specific Heat of a Metal (LM pp. 115-121) Heats of Reaction (LM pp. 123-130)	Endothermic Reaction TE p. 294 Exothermic Reaction TE p. 305 Release of Heat TE p. 310 Thermite TE p. 316
Hydrocarbon Compounds	Chapter 25 pp. 742-771	Hydrocarbons: A Structural Study (LM pp. 307-313)	Models of Hydrocarbons TE p. 744 Structural Formulas TE p. 745

Curriculum Map For Chemistry I

Organizing Concepts	Aug.	Sept.	Oct	Nov	Dec	Jan
Standard1.0 Atomic Structure		-Descirbe various atomic models (L2). -Calculate subatomic particles in neutral atom, ion, or isotope (L2).	-Compare atomic orbitals (L2). -Write elec. configurations (L2). -Summarize development of periodic table (L2). -Categorize elements into 4 classifications (L1) -Interpret periodic trends (L3).			-Apply Lewis structures/ octet rule to predict charges (L2).
Standard 2.0 Matter and Energy	- Apply lab safety rules (L2). -Apply scientific method(L2) -Classify matter (L1). -Distinguish physical from chemical properties and changes. (L1).	-Use correct significant figures and SI units (L2). -Calculate density from experimental data. (L1) -Solve problems using dimensional analysis.(L2)		Apply the law of conservation of matter (L2).		-Describe 3 states of matter (L2). -Apply the gas laws in calculations (L2)
Standard 3.0 Interactions of Matter			-Write formulas for ionic and molecular compounds and acids (L2).	-Analyze percent composition of compounds. (L2)-Convert between mass, molecules, moles and volume of gases at STP (L2) -Balance and tell types of chemical equation (L2).	-Perform stoichio-metric calculations (L3). -Identify limiting reagent (L3). -Calculate percent yield (L3).	
Standard 4.0 Solutions and Acids/Bases	-Identify the solute and solvent in,a solution(L2).					

Technology Resources



Chemistry Videos

This list was complied from Medianet on the Shelby County Home Page. This is a partial list. Many more are available at the Board of Education Video Library.

Lab Safety

Title **School Lab Safety (06284)**
Physical Color; Sound; 20 minutes
Produced 1980
Synopsis This film points to more than fifty of the most common lab injuries and stresses the necessary precautions that should be taken by students and teachers.

Matter and Change

Title **Investigations in Chemistry: Experiments and Observations Series: Matter and Change (08935)**
Physical Color; Sound; 30 minutes
Produced 1997
Distributor FOTH 1993 (570)
Audience High (Grades 9-12) (H)
Series Investigations in Chemistry: Experiments and Observations Se (0063)
Synopsis In lesson one of this program, experiments are conducted on five white powders to determine chemical content and reaction. Lesson two shows the three states of bromine. In Lesson three, the density of solids and liquids is examined.

Scientific Measurement

Title **Scientific Measurement (05542)**
Physical Color; Sound; 18 minutes
Produced 1987
Distributor BAAR (452)
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Synopsis This video examines a variety of measurements and shows how instrumental measurement is to science and research.

Title **The World of Chemistry: Parts 3-4 (03448)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 3: Measurements: The Foundation of Chemistry -The distinction between accuracy and precision and their importance in commerce and science. Part 4: Modeling the Unseen -Models are used to explain phenomena that are beyond the realm of ordinary perception.

Atomic Structure

Title **Essentials of Chemistry Series: Atomic Structure: Mapping an Invisible World (08627)**
Physical Color; Sound; 23 minutes
Produced 1996
Distributor FILMID (87)
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Series Essentials of Chemistry Series (0116)
Synopsis Dynamic animation brings to life the invisible world of the atom: Subatomic particles, antiparticles, isotopes, atomic number, mass, radioactive particles. The video shows how radioactive isotopes are used to detect and fight disease, monitor the flow of pesticides and date fossil remains.

Title **The World of Chemistry: Parts 5-6 (03449)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 5: A Matter of State -Matter in its three principal states—gases, liquids, and solids; relating the visible world to the submicroscopic. Part 6: The Atom -A journey inside the atom to appreciate its architectual beauty and grasp how atomic structure determines chemical behavior.

Electrons in Atoms

Title **Structure of the Atom Series: Bohr Model (08876)**
Physical Color; Sound; 10 minutes
Produced 1992
Distributor FOTH 1993 (570)
Audience High (Grades 9-12) (H)
Series Structure of the Atom Series (0054)
Synopsis Niels Bohr was able to salvage Rutherford's model of the atom in spite of its shortcomings. Bohr studied quantized energies, orbit radii, and electron velocities and concluded that electrons may occupy only certain precise orbits, or energy levels. He was then able to predict the speed and energy of the electron in each orbit, using the simplest atom, hydrogen.

Periodic Table

Title **Essentials of Chemistry Series: Periodic Table: Reactions and Relationships (08628)**
Physical Color; Sound; 23 minutes
Produced 1996
Distributor FILMID (87)
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Series Essentials of Chemistry Series (0116)
Synopsis The Periodic Table contains a wealth of information and this program helps viewers learn how to access it. It also outlines the physical and chemical qualities of the members of each group of elements from alkaline metals to the noble gases.

Title **Simply Science Series: The Periodic Table (03990)**
Physical Color; Sound; 27 minutes
Produced 1989
Distributor AGC (833)
Audience High (Grades 9-12) (H)
Series Simply Science Series (0180)
Synopsis This video reviews Mendeleev's periodic table and the theory of the nuclear structure of the atom. An examination of Bohr's model of the atom explains how this theory led to the organization of the modern periodic table. The video then explores the modern periodic table, comparing it to Mendeleev's and uses it to make predictions about the chemical properties and reactions of representative elements.

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Ionic and Covalent Bonds

Title **Chemical Bonding and Atomic Structure (2nd Ed.) (04714)**
Physical Color; Sound; 23 minutes
Produced 1983
Distributor CORF (384)
Audience Junior (Grades 6-8), High (Grades 9-12) (JH)
Synopsis Discusses ion, atoms, valence, polarity and chemical properties of elements and compounds.

Title **Essentials of Chemistry Series: Compounds: Electromagnetic Attraction in Molecules (08626)**
Physical Color; Sound; 23 minutes
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Series Essentials of Chemistry Series (0116)
Synopsis This program shows how compounds are formed by either ionic or covalent bonding; the difference between various groups of compounds such as acids, bases, hydrocarbons, chemical formulas; and chemical equations and exothermic, endothermic and neutralization reactions.

Chemical Names and Formulas

Title **Simply Science Series: Reaction Equations (03991)**
Physical Color; Sound; 27 minutes
Produced 1989
Distributor AGC (833)
Audience High (Grades 9-12) (H)
Series Simply Science Series (0180)
Synopsis This video introduces formation and decomposition reactions. It starts with a review of the evidence for a chemical reaction. By testing a few compounds, a method of classifying them as molecular, ionic, acid or base is developed. The law of conservation of mass is applied to balance the reaction equation. The rules for naming binary compounds are introduced.

Molar Relationships

Title **The World of Chemistry: Parts 11-12 (03452)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 11: The Mole -Using Avogadro's law to relate the mass of a substance to the number of particles contained in that mass. Part 12: Water -The special chemical properties of water; the need for its protection and conservation.

States of Matter

Title **Science Key Concepts Series: Chemistry/Physics: Molecular motion (07440)**
Physical Color; Sound; 15 minutes
Produced 2000
Distributor BNCHMK (642)
Audience High (Grades 9-12) (H)
Series Science Key Concepts Series (0277)
Synopsis This program llustrates through the use of imaginative demonstrations the evidence for the particle theory—Brownian motion, diffusion of gases in air, and the changes of states of matter.

Title **The World of Chemistry: Parts 5-6 (03449)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 5: A Matter of State -Matter in its three principal states—gases, liquids, and solids; relating the visible world to the submicroscopic. Part 6: The Atom -A journey inside the atom to appreciate its architectural beauty and grasp how atomic structure determines chemical behavior.

Properties of Solutions

Title **Solutions: Ionic and Molecular (2nd Ed.) (04724)**
Physical Color; Sound; 23 minutes
Produced 1983
Distributor CORF (384)
Audience Junior (Grades 6-8), High (Grades 9-12) (JH)
Synopsis The chemical nature of a solution is illustrated along with the role of electrostatic forces. The Brownian movement is seen, saturation defined, and the concept of polarity is presented with an explanation of why some substances, like oil, won't dissolve.

Reaction Rates and Equilibrium

Title **Essentials of Chemistry Series: Reactions: The Chemistry of Change (08629)**
Physical Color; Sound; 23 minutes
Produced 1996
Distributor FILMID (87)
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Series Essentials of Chemistry Series (0116)
Synopsis This program covers exothermic, endothermic, spontaneous and non-spontaneous reactions. Variables such as temperature, concentration and how the presence of a catalyst affects the rate of chemical reactions.

Title **The World of Chemistry: Parts 13-14 (03453)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 13: The Driving Forces -Endothermic and exothermic reactions and the role of entropy. Part 14: Molecules in Action -Observing molecules during chemical reactions to see the role of catalysts; dynamic equilibrium.

Acids and Bases

Title **Investigations in Chemistry: Experiments and Observations Series: Acids, Bases and Neutralization (08940)**
Physical Color; Sound; 30 minutes
Produced 1997
Distributor FOTH 1993 (570)
Audience High (Grades 9-12) (H)
Series Investigations in Chemistry: Experiments and Observations Se (0063)
Synopsis In lesson one, five aqueous solutions are tested for degrees of acidity and alkalinity. In lesson two, mixing small pieces of aluminum with solutions of hydrochloric acid and sodium hydroxide produces table salt. A third lesson demonstrates precautions that should be taken when performing experiments involving heat.

Title **Acids, Bases and Salts (2nd Ed.) (04733)**
Physical Color; Sound; 20 minutes
Produced 1983
Distributor CORF (384)
Audience Junior (Grades 6-8), High (Grades 9-12) (JH)
Synopsis This video explains how acids are proton donors and bases are proton acceptors, and discusses neutralization and salts.

Title **The World of Chemistry: Parts 15-16 (03454)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)

Synopsis Part 15: The Busy Electron -The principles of electrochemical cell design explained through batteries, sensors, and a solar-powered car. Part 16: The Proton in Chemistry -How pH is measured and the important role of acids and bases.

Title **World of Natural Science Series: Acids and Bases (08882)**
Physical Color; Sound; 14 minutes
Produced 1996
Distributor FOTH 1993 (570)
Audience High (Grades 9-12) (H)
Series World of Natural Science Series (0056)
Synopsis This program explains the characteristics of acids and bases, the process of neutralization, and the concept of pH. The high school conservation camp's presenters and scientists explain experiments being done on lake acidification.

Thermochemistry

Title **Essentials of Physics Series: Heat and the Changing States of Matter (08638)**
Physical Color; Sound; 23 minutes
Produced 1996
Distributor FILMID (87)
Audience Intermediate (Grades 3-5), High (Grades 9-12) (IH)
Series Essentials of Physics Series (0118)
Synopsis This program explains how thermal energy causes matter to change states, expand and contract, and how thermal energy is transferred by convection, conduction and radiation. Also covered is how different materials vary in their specific heat capacity and thermal conductance. These many concepts are illustrated by footage of steel mills, solar and geothermal power plants, wind forms, the flight of hot air balloons and 3-D animation.

Hydrocarbon Compounds

Title **The World of Chemistry: Parts 21-22 (03457)**
Physical Color; Sound; 60 minutes
Produced 1990
Distributor ANNCPB (802)
Audience High (Grades 9-12) (H)
Synopsis Part 21: Carbon -The versatility of carbon's molecular structures and the enormous range of properties of its compounds. Part 22: The Age of Polymers -How chemists control the molecular structure to create polymers with special properties.

Websites

It is recommended that the teachers review these sites before using. The authors are not responsible for links within sites.

Lesson Plans for Chemistry
www.teach-nology.com/teachers/lesson_plans/science/chemistry
contains over 300 lesson plans for teaching chemistry, many worksheets, and power point templates

http://www.iit.edu/~smile/cheminde.html
contains over 200 lesson plans for chemistry

Tutorials
www.chemistrycoach.com
original tutorials for a variety of topics; study skills for chemistry courses

www.dun.org/sulan/chembalancer
learn about balancing equations by playing a game. This is a

http://dbhs.wvusd.k12.ca.us/ChemTeamIndex.html
contains some great tutorials on some of the more difficult topics

Web quests
http://www.chemheritage.org/EducationalServices/webquest/home.htm
web quests that investigate topics such as the chemistry of the Hindenburg disaster, Evidence for Atoms, and many others

http://www.westirondequoit.org/inservice/Chemistry.htm
web quests on Modern Atomic Theory, Forensics, Acid Rain, and many others

Miscellaneous Sites
www.chemfiesta.com
helpful tips, lots of worksheets, and labs

www.chemmybear.com
contains mole clip art, animated molecules, and interesting information on many of the elements

www.thecatalyst.org
resources for secondary education teachers on the World Wide Web

http://chemed.chem.purdue.edu/~sreed/chemteach.html
helpful ideas for high school chemistry teaching

www.phschool.com
contains Science News updates, activities for each chapter of the textbook, self-tests, and other sites

http://www.quia.com/dir/chem
20 activities and games emphasizing various chemistry topics

http://www.highschoolhub.org/hub/hub.cfm
offers problem sets and tutorials for students, as well as a number of "kitchen" chemistry experiments; also has a great printable version of the periodic table

Themes & Essential Questions For Chemistry I

Themes and Essential Questions

Theme
What is matter composed of and how does it change?

Essential Questions
How is chemistry used to make new materials?

What is the makeup and internal arrangement of matter and how does that affect its properties?

How does matter behave when it is heated, cooled, or mixed with other materials and why does this behavior occur?