Unit I Introduction

Understand the basis of chemistry and scientific measurements.
   Measure volume, mass, and density.
   Identify equipment used in a beginning chemistry lab. (A minimum of 90%)
   Understand and use the Scientific Method.
   Demonstrate the process of the scientific method.
   Use the scientific method to classify observations.
Use the concepts of dimensional analysis, scientific notation & significant figures to solve problems.
   Use the Metric (International) System (SI) to make measurements and in solving problems.
   Use dimensional analysis to solve problems and perform unit conversions.
   Use scientific notation to represent very large and very small numbers and to correctly use scientific notation in calculations.
   Determine the number of significant figures in a measurement and to use this to correctly report answers.
   Know the difference between accuracy and precision.
Be able to classify matter and identify changes in properties.
   Classify mixtures as heterogeneous or homogeneous and understand the differences between mixtures and pure substances.
   Identify and give examples of physical and chemical changes.
Measure and calculate energy transfers and changes.
   Understand the difference between energy and temperature.
   Calculate and measure energy changes.

Key terms: matter, energy, potential energy, kinetic energy, radiant energy, law of conservation of mass, law of conservation of energy, scientific model, scientific theory, scientific law, hypothesis, weight, mass, gram, meter, kelvin, accuracy precision, significant digit, density, mixture, phase, heterogeneous, homogeneous, solution, solute, solvent, substance, element, compound, physical change, chemical change, physical property, chemical property, heat, joule, endothermic, exothermic, specific heat.

Suggested Problems: Read Chapters 1 & 2
pg 19 (8-12), pgs 31-34 (1, 6, 10, 30-32, 36-38, 46-49) pg 45 (7, 8, 13) pg 53 (1, 2, 4-9) pg 63 (1-9) pgs 66-70 (6-8, 32-36, 47-57)

Unit II Atomic Structure

Be aware of early atomic models.
Know the atomic properties and nomenclature.
   Know the relative size, mass and position of protons, neutrons and electrons in atoms.
   Know the difference between atomic mass, mass number and atomic number.
   Be able to determine the number of protons, neutrons and electrons in an identified isotope of an element.
   Be aware of other subatomic particles.
Identify and solve problems of basic radioactivity
   Know the three basic types of radiation.
   Predict and balance radioactive equations.
   Be able to do half life calculations.
Be able to calculate average atomic mass.

Key Terms: cathode ray tube (CRT), atomic number, nucleon, mass number, radioactivity, alpha radiation, beta radiation, gamma radiation, electromagnetic energy, frequency, hertz, wavelength, quantum theory, quanta, photon, atomic mass, half life.

Important people of history: Dalton, Rutherford, Thompson, Bohr, Marsden, Geiger, Schrodenger

Suggested Problems: Read Chapter 3 – Sections 1 & 2, Chapter 18
pg 78 (1, 4, 5) pg 89 (1-8) pgs 107-112 (1, 2, 4, 5, 13, 16, 18, 22, 39-46) pg 647 (5&6) pg 657 (5, 6, 9) pg 666 (1-8) pgs 669-674 (18, 19, 26, 30-44, 50, 53, 54, 56-59, 65-69)

Unit III The quantum mechanical model of the atom and the periodic table

Be able to describe energy related to the electromagnetic spectrum in terms of color, wavelength and frequency.
   Know how the color of light is related to frequency and energy.
   Be able to calculate the energy of light.
Know the major characteristics of the quantum mechanical model of the atom.
   Be aware of the historical development of the atom.
   Describe the wave-mechanical view of the atom.
   Describe the position and characteristics of protons, neutrons and electrons.
   Use quantum numbers and electron placement rules to describe the location of electrons. (write electron configurations)
   Write electron dot diagrams.
Understand and use the mole and Avogadro's number.
   Be able to calculate the number of atoms given moles or mass of an element.
   Be able to calculate the mass of an element given the number of atoms or moles.
Know the Periodic Table.
   Know the development of the periodic table and it's importance.
   Use the periodic table to predict electron configurations.
   Identify selected groups of elements on the periodic table.
   Predict properties of the elements based on periodic trends of atomic size, electron affinity, electronegativity and ionization energy.

Terms: Wave -particle duality, momentum, quantum, quantum number, electron cloud, principal quantum number, sublevel, orbital, periodic law, transition element, period, group, family, metal, nonmetal, metalloid, alkali metal, alkaline earth metal, chalcogens, halogens, noble gas, ionization energy, shielding effect, electron affinity, electronegativity.

Suggested Problems: Read Chapter 3 (sections 3 & 4) and Chapter 4 (Sections 1-3)
pg 99 (1-11) pg 104 (4-11) pgs 107-112 (10, 23-27, 29-34, 44, 47-59, 61, 63, 64, 65, 68-73, 76-82, 90-92, 95-98, 101) pg 122 (3-10) pg 131 (1-6) pg 141 (1-5, 9-11) pgs 150-154 (19-22, 29-32, 60, 71)

Unit IV Chemical Bonding

Be able to write formulas for binary ionic compounds.
Be able to write names for binary ionic compounds.
Be able to write formulas for binary covalent compounds.
Be able to write names for binary covalent compounds.
Be able to distinguish between ionic, covalent and polar covalent bonds.

Terms: chemical symbol, ion, chemical formula, oxidation number, ionic compound, molecule, binary compound, molecular formula, empirical formula, formula unit, electronegativity, polar bond, valence electron.

Suggested Problems: Read Chapter 5 & Chapter 6 (Sections 1&2)
pg 165 (1-11) pg 175 (1, 2, 8) pgs 183-186 (1-5, 8, 37, 40) pg 198 (1, 3, 4, 14) pg 207 (6, 7, 9, 10, 13) pgs 216-220 (2, 7-11, 15, 18, 26, 32, 41, 60)

Unit V Chemical Nomenclature

 Be able to write formulas for binary and polyatomic ionic compounds (including the stock system).
 Be able to write names for binary and polyatomic ionic compounds (including the stock system).
 Be able to write formulas and name binary covalent compounds.
The student must be able to do this with at least a 90% accuracy before moving on to the next unit.

Suggested Problems: Do what you need -you will have many worksheets and access to computer programs for practice. Pay particular attention to Chapter 5, Section 3.

Unit VI Chemical Quantities

 Be able to solve problems using scientific notation and dimensional analysis (the factor-label method).
 Be able to solve problems using the concepts of a mole, molar mass and Avogadro's number.
 Be able to solve problems using molarity and percents.
 Be able to calculate percent composition of compounds.
 Be able to calculate Empirical and Molecular Formulas.
 Be able to determine the percent of water in a hydrate.

Terms: molecular mass, formula mass, molar mass, mole, Avogadro constant, molarity, percent composition, hydrate, empirical formula, molecular formula

Important people of history: Avogadro

Suggested Problems: Read Chapter 7 & Chapter 13 Section 2
pg 233 (1-13) pg 240 (8-12) pg 248 (4-8) pgs 251-256 (1-3, 14, 16-18, 22-58, 62-84) pg 467 (2-12) pgs 488-492 (47-61)

Unit VII Chemical Reactions

 Be able to predict synthesis, single replacement, double replacement, decomposition and combustion reactions.
 Be able to balance chemical reactions, including redox reactions
 Be able to calculate mass, mole, and volume relationships in chemical reactions (Stoichiometry).

Terms: chemical reaction, reactant, product, single displacement, double displacement, decomposition, synthesis, combustion, stoichiometry, mass-mass problem, mass-mole problem, mass-volume problem, oxidation, reduction, oxidizing agent, reducing agent.

Suggested Problems: Read Chapter 8, Chapter 9 and Chapter 17
pg 266 (1, 5-10, 17) pg 274 (4-6, 9, 10) pg 285 (8-10) pg 289 (6-11) pgs 292-298 (31-40, 46-48, 51-60, 73-76) pg 311 (4, 5) pg 319 (7-12) pgs 329-334 (6-9, 27-41, 54-59) pg 611 (1-11) pg 615 (1-4, 9, 10) pg 624 (3, 5-7) pgs 634-638 (39-65)

Unit VIII Kinetic theory

 Be able to relate temperature and energy transfer to molecular motion.

Determine the relative motion and properties of the three common states of matter.
Be able to describe characteristics of substances in each of the three common states of matter in terms of the kinetic theory and bonding in the substances.
Be able to relate pressure to molecular motion.
Be able to calculate pressure in manometers.
Be able to calculate energy changes for the change in temperature or phase of substances.

Terms: kinetic theory, pressure, manometer, barometer, absolute zero, Kelvin scale, plasma, vapor, melting point, sublimation, normal boiling point, volatile, phase diagram, triple point, enthalpy of fusion, enthalpy of vaporization, hydrogen bond, surface tension, vanderWaals forces.

Suggested Problems: Read Chapter 11
pg 384 (1-13) pg 392 (1-8) pg 398 (1-9) pg 405 (1-10) pgs 408-412 (1, 5, 6, 8-21, 24-27, 44-47, 83)

Unit IX Gas Laws

Be able to solve problems using the combined gas law (Boyle's, Charles', GayLussac's) and Dalton's Law of Partial Pressure.
Be able to mass to volume or molarity to volume problems using the ideal gas law or Avogadro's principle with the combined gas law.
Know the implications of Graham's Law of diffusion.
Be able to do stoichiometry with excess and limiting reactants.

Terms: ideal gas, STP, standard temperature, standard temperature, standard conditions, diffusion, Avogadro's Principle, molar volume, limiting reactant, excess reactant

Suggested Problems: Read Chapter 12
pg 422 (8-10) pg 432 (5-10) pg 442 (7-9, 11-12) pgs 445-450 (31-58, 63-83)

Unit X Reaction Rates & Equilibrium

Be able to describe the factors that influence the rate of a reaction.
Be able to describe and determine reaction mechanisms for simple reactions.
Be able to describe the properties and effects of catalysts and inhibitors.
Be able to determine rate laws and calculate reaction rates.
Be able to determine equilibrium expressions and calculate constants &concentrations.
Be able to use LeChatelier's principle to explain the effects of changes in equilibrium.

Terms: thermodynamically stable, kinetically stable, reversible reaction, reaction rate, activated complex, rate constant, homogeneous reaction, heterogeneous reaction, catalysis, heterogeneous catalyst, homogeneous catalyst, inhibitor, rate determining step, reaction mechanism, optimum conditions.

Suggested Problems: Read Chapter 16 and Chapter 14
pg 585 (1, 3-6, 13) pg 595 (3-8, 12) pgs 597-600 (22, 24-32) pg 501 (1-4) pg 511 (1-3, 5-9) pg 518 (1-3, 5-7) pgs 521-526 (13-48)

Unit XI Reaction Energy

Be able to calculate and explain energy changes for reactions
Be able to calculate and explain entropy changes for reactions
Be able to calculate free energy changes for a reaction and use it to determine reaction spontaneity

Know the 3 laws of thermodynamics

Terms: thermodynamics, internal energy, enthalpy, entropy, Gibbs free energy, exothermic, endothermic, exergonic, endergonic.

Suggested Problems: Read Chapter 10
pg 344 (8-13) pg 349 (4-9) pg 357 (4-6) pg 367 (3-12) pgs 370-374 (27-55)

Unit XII Acids, Bases, Salt and pH
Be able to name common acids and bases
Be able to identify common acids & bases and their properties
Be able to write equations for common acid base neutralization
Be able to calculate acid or base concentrations from titration data
Be able to write equations for Bronsted-Lowry acids & bases
Be able to determine the percent ionization
Be able to calculate pH and pOH
Be able to calculate hydrogen and hydroxide ion concentration from pH or pOH
Be able to calculate equilibrium constants for acids, bases & salts
Be able to describe the equilibrium effect of weak acids , weak bases and buffers
Be able to explain the common ion effect.

Terms: electrolyte, hydronium ion, conjugate base, conjugate acid, binary acid, ternary acid, amphoteric, anhydrous, strong acid, strong base, weak acid, weak base, salt, spectator ion, polyprotic acid, ionization constant, common ion effect, solubility product constant, ion product constant of water, pH, pOH, hydrolysis, indicator, titration, standard solution

Suggested Problems: Read Chapter 15
pg 538 (1, 2, 6, 10, 13) pg 547 (1-5, 7-12, 14) pg 556 (8-12) pg 563 (2-4, 6-10) pgs 566-572 (21-26, 40-100 evens)

Unit XIII Organic Chemistry
Be able to distinguish between organic and inorganic chemistry
Be able to distinguish between saturated and unsaturated hydrocarbons
Be able to name alkanes, alkenes, alkynes and alcohols
Be able to draw structures for alkanes, alkenes, alkynes and alcohols
Be able to define and give examples of isomerization
Be able to classify reactions of organic compounds as addition, substitution, condensation, elimination or combustion
Be able to define and give examples of polymerization
Be able to describe the relevance of organic chemistry in areas such as petroleum engineering and drug synthesis
Be able to describe carbohydrates, proteins and nucleic acids as biological polymers

Terms: organic chemistry, hydrocarbon, saturated, unsaturated, homologous, alkane, alkene, alkyne, IUPAC, isomer, addition reaction, substitution reaction, elimination reaction, condensation reaction, monomer, polymer, functional group, aromatic, benzene

Suggested Problems: Read Chapter 19

pg 686 (3, 4, 5, 7-12, 14) pg 695 (1, 2, 6-8, 12, 14) pg 701 (2, 4, 6-8) pgs 705-707 (38, 39, 43, 36, 50, 51)