Chemistry II

Chemistry II: Grade 12				
Learning Standards	**Objectives**	**Resources**	**Time Allotment**	**SHS Student Expectations**
Learning Standard #1 Atomic theory and atomic structure				
Learning Standard # 1.1 Evidence for the atomic theory	The student will be able to: • Summarize the experiments that characterized the structure of the atom. • Describe features of subatomic particles.	Masterton: ch. 2 pgs. 33-36 Demo: Electronegativity, Atomic Diameter, and Ionization Energy Lab: Densities of Liquids and Solids	4 days	1, 3, 4, 5
Learning Standard # 1.2 Atomic masses; determination by chemical and physical means	The student will be able to: • Describe the modern atomic mass scale and explain how atomic masses are determined experimentally. • Show how to calculate values for molar mass.	Masterton ch. 2 pgs. 37-50 Lab: Resolution of Matter into Pure Substances Lab: Mass Analysis of Metal Oxides Lab: Law of Multiple Proportions	5 days	1, 3,4, 5
Learning Standard # 1.3 Atomic number and mass number; isotopes	The student will be able to: • Explain the use of the symbol ${}^{A}_{Z}X$ to describe a given atom.	Masterton ch. 2 pgs. 39-40	1 day	1, 3, 4, 5
Learning Standard # 1.4 Electron energy levels; atomic spectra, quantum numbers, atomic orbitals	The student will be able to: • Characterize electromagnetic radiation in terms of wavelength, frequency, and speed. • Explain the concept of quantized energy. • Show that light has both wave and particle properties. • Explain how the line spectrum of hydrogen demonstrates the quantized nature of all matter. • Describe the development of the Bohr model for the hydrogen atom. • Explain the quantum numbers n. l, m_l, and m_s.	Masterton ch. 7 pgs. 192-219 Lab: Atomic Spectrum of Hydrogen	6 days	1, 3,4, 5

	• Explain the Aufbau principle.			
Learning Standard # 1.5 Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states	The student will be able to: • Trace the development of the periodic table. • Show general trends in ionization energy, electron affinity, and atomic radius in the periodic table. • Show what types of information can be obtained from the periodic table.	Masterton ch. 1 pg 15-18 ch. 8 pgs. 225-237	3 days	1, 3,4, 5
Learning Standard # 2 Chemical bonding				
Learning Standard # 2.1 Binding forces: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)	The student will be able to: • Explain why an ionic bond is formed. • Explain why a covalent bond is formed. • Define lattice energy. • Define dipole-dipole forces, hydrogen bonding, and London dispersion forces. • Describe the effects forces have on the properties of liquids and solids.	Demo: Cu + S : Lab: Determination of a Chemical Formula Masterton ch. 9 pgs. 259-266	4 days	1, 3,4, 5
Learning Standard # 2.2 Binding forces: polarity of bonds, electronegativities	The student will be able to: • Discuss the nature of bonds in terms of electronegativity. • Define the relationship between bond polarity and molecular polarity. • Show the relationship between electronegativity and the ionic character of a bond.	Lab: Preparation of Aspirin Masterton ch. 9 pgs. 267-272	3 days	1,2, 3,4, 5

Learning Standard # 2.3 Molecular models: Lewis structures	The student will be able to: • Demonstrate how to write Lewis structures.	Lab: Lewis Structures Masterton ch. 9 pgs. 273	4 days	1,2, 3,4 5
Learning Standard # 2.4 Molecular models: valence bond: hybridization on orbitals, resonance, sigma and pi bonds.	The student will be able to: • Illustrate how to write resonance structures. • Predict the hybridization of an atom in a molecule. • Identify sigma and pi bonds.	Masterton ch. 9 pgs. 278-280, ch. 9 pgs. 407-420 Lab: Molecular model kit	3 day	1,2, 3, 45
Learning Standard # 2.5 Molecular models: VSEPR	The student will be able to: • Explain how molecular geometry can be predicted from the number of electron pairs.	Masterton ch. 8 pgs. 274-277	2 days	1, 3, 4, 5
Learning Standard # 2.6 Geometry of molecules and ions, structural isomerism of coordination complexes; dipole moments of molecules; relation of properties to structure	The student will be able to: • Predict the isomers of coordination complexes. • Recognize polar and nonpolar molecules.	Masterton ch. 8 pgs. 271, ch. 21 pgs 635-641	2 days	1, 3,4, 5
Learning Standard # 3 Nuclear chemistry				
Learning Standard # 3.1 Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications	The student will be able to: • Relate the stability of a nucleus to the number of protons and neutrons. • Classify types of radioactive decay. • Define and show how to calculate the half-life of a radioactive nuclide. • Show how objects can be dated using radioactive decay. • Show how radiation damages human tissue.	Masterton ch. 27 pgs. 799-822	2 days	1, 3, 4, 5

Learning Standard # 4 Gases				
Learning Standard # 4.1 Laws of ideal gases: equation of state for an ideal gas	The student will be able to: • Use the ideal gas law. • Define the molar volume for an ideal gas. • Define STP.	Lab: Determination of the molar volume of a gas Demo: Gas Densities Masterton ch. 6 pgs. 157-167	4 days	1,2, 3,4, 5
Learning Standard # 4.2 Laws of ideal gases: partial pressures	The student will be able to: • State the relationship between partial pressures and total pressure and between partial pressure and mole fraction.	Demo: Crushing cans Masterton ch. 6 pgs. 171-172	1 day	1,2, 3, 5
Learning Standard # 4.4 Kinetic molecular theory: Avogadro's hypothesis and the mole concept	The student will be able to: • Do stoichiometric calculations for reactions involving gases. • Calculate molar mass from gas density.	Lab: Determination of molar mass by vapor density Masterton ch. 6 pgs. 168-170	3 days	1,2,3,4, 5

Learning Standard # 4.5 Kinetic molecular theory: dependence of kinetic energy of molecules on temperature	The student will be able to: • Define temperature.. • Describe effusion and diffusion.	Masterton ch. 6 pgs. 177-179 Demo: Temperature and Pressure Relationships	1 day	1,2, 3, 5
Learning Standard # 4.6 Kinetic molecular theory: deviations from ideal gas laws	The student will be able to: • Describe how real gases deviate from ideal behavior. • Show how the van der Waal's equation allows for real conditions.	Masterton ch. 6 pgs. 175 Demo: Production of Gas: Acetylene Demo: A Chemical Pop Gun	1 day	1,2, 3,4, 5
Learning Standard # 5 Solutions				
Learning Standard # 5.1 Types of solutions and factors affecting solubility	The student will be able to: • Show how molecular structure, pressure, and temperature affect solubility.	Masterton ch. 12 pgs. 354-358, 365-368 Demo :The Effect of Temperature on a Hydrate	1 day	1, 3,4, 5
Learning Standard # 5.2 Methods expressing concentration	The student will be able to: • Define various ways of describing solution composition.	Demo: Patriotic Colors: Red, White, and Blue Masterton ch 12 pgs. 358-364	2 days	1, 3, 5
Learning Standard # 5.3 Raoult's law and colligative properties (nonvolatile solutes); osmosis	The student will be able to: • Show how a solution's vapor pressure is affected by the concentration of solute and the interactions of solute and solvent. • Predict and calculate the effect of a solute on the boiling and freezing points of a solvent. • Explain osmosis and describe its application • Show how the colligative properties of electrolyte solutions can be used to characterize the solute.	Lab: Determination of molar mass by freezing point depression Masterton ch. 12 pgs. 368- 379	4 days	1,2, 3,4, 5
Learning Standard # 6 Qualitative analysis				
Learning Standard # 6.1 Complex ions- formation and decomposition	The student will be able to: • Discuss the formation and decomposition of complexions. • Predict whether a complex ion will form.	Demo: Colorful precipitates Lab: Qualitative analysis of Group I Cations Masterton ch. 22 pgs. 664-674	5 days	1,2,3,4 ,5

	• Predict coordination number and products of the transition metals.			
Learning Standard # 6.2 Precipitation reactions	The student will be able to: • Predict whether a solid will form in a solution reaction. • Write complete ionic and net ionic equations. • Demonstrate stoichiometric calculations involving precipitation reactions.	Lab: Separation and qualitative analysis of cations and anions Masterton ch. 22 pgs. 675-681	5 days	1,2, 3,4, 5
Learning Standard # 6.3 Oxidation-reduction reactions: oxidation number	The student will be able to: • Characterize oxidation-reduction reactions. • Assign oxidation states.	Lab: Spot Test for Common Ions Demo: Chemistree Video: World of Chemistry: The Busy Electron Masterton ch. 23 pgs. 687-689	3 day	1,2, 3,4, 5
Learning Standard # 6.4 Oxidation-reduction reactions: the role of the electron in oxidation-reduction	The student will be able to: • Identify oxidizing and reducing agents. • Use the half-reaction method for balancing oxidation-reduction reactions.	Lab: Ten Test Tube Mystery Masterton ch. 23 pgs. 690-699	3 days	1,2, 3,4, 5
Learning Standard # 7 Stoichiometry				
Learning Standard # 7.2 Balancing equations including those for redox reactions	The student will be able to: • Write empirical and molecular formulas. • Calculate mass percents of the elements in a compound. • Write a balanced equation to describe a chemical reaction. • Use the half-reaction method for balancing oxidation-reduction reactions.	Demo: Rapid reduction of hydrogen peroxide Masterton ch. 3 pgs. 61-75	2 days	1,2 3,4,5
Learning Standard # 7.3 Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants	The student will be able to: • Perform stoichiometric calculations involving precipitation reactions. • Show how to perform calculations involved in acid-base volumetric	Lab: Determination of mass and mole relationships in a chemical reaction Lab: Determination of the percentage of water in a hydrate	6 days	1,2,3,4, 5

	analysis. • Calculate masses of reactants and products using the chemical equation. • Demonstrate the use of limiting reactant in stoichiometric calculations.	Masterton ch. 3 pgs. 76-90		
Learning Standard # 8 Thermodynamics				
Learning Standard # 8.1 Exothermic and Endothermic reactions; Enthalpy changes	The student will be able to: • Distinguish between endothermic and exothermic rections • Identify the change in enthalpy	Lab: Heat Effects and Calorimetry Masterton ch. 5 pgs 120-122	4 days	1,2, 3,4, 5
Learning Standard # 8.2 Thermochemical Equations, Heats of Formation	The student will be able to: • Apply the basic laws of thermochemistry • Use Hess's Law to calculate the change in enthalpy	Masterton ch 5 pgs 123-134	2days	1,3,4,5
Learning Standard # 8.3 Calorimetry**,** Measurement of heat flow	The student will be able to: • Write a thermochemical equation • Calculate the change in enthalpy in a chemical reaction	Masterton ch 5 pgs 135-139	2 days	1,3,4,5
Learning Standard # 8.4 Enthalpy, Energy, and the First Law of Thermodynamics	The student will be able to: • State the first law of thermodynamics • Review energy sources available today and speculate about energy sources of the future	Masterton ch 5 pgs 140-150	2 days	1,4,5
Learning Standard # 9 Equilibrium				
Learning Standard # 9.1 Concept of dynamic equilibrium, physical and chemical; LeChatelier's principle; equilibrium constants	The student will be able to: • Discuss how equilibrium is established. • Calculate equilibrium constants.	Lab: Determination of the equilibrium constant for a chemical reaction (done by spectrophotometric analysis) Masterton ch. 15 pgs 448-467	5 days	1,2 3,4,5

	• Show how the equilibrium constant is used to predict the direction a system will move to reach equilibrium. • Predict the changes that occur when a system at equilibrium is disturbed.			
Learning Standard # 9.2 Equilibrium constants for gaseous reactions: Kp, Kc	The student will be able to: • Show how K_c and K_p are related. • Calculate equilibrium concentrations given initial concentrations.	Masterton ch. 15 pgs 468-470	3 days	1, 3,4,5
Learning Standard # 9.3 Equilibrium constants for reactions in solutions: constants for acids and bases; pH, pK_a	The student will be able to: • Define pH, pOH, and pK and use general methods to solve acid-base problems. • Calculate percent dissociation. • Solve equilibrium problems of weak acids and weak bases. • Calculate the pH of acidic and basic solutions. • Explain the characteristics of buffered solutions. • Calculate the pH at any point in an acid-base titration.	Lab: Standardization of solution using a primary standard Lab: Determination of concentration by acid-base titration including a weak acid or weak base Lab: Determination of appropriate indicators for various acid-base titrations Demo:Acid-Base Indicators and pH Masterton ch. 20 pgs 614-624	10 days	1, 2,3,4, 5
Learning Standard # 9.4 Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds	The student will be able to: • Calculate the solubility product of a slat given its solubility and vice-versa. • Predict relative solubilities based on K_{sp} values. • Predict if precipitation will occur when solutions are mixed.	Demo: Colorful precipitates Masterton ch. 18 pgs 555-566	4 days	1, 3,4, 5
Learning Standard # 10 Introduction to organic chemistry:				
Learning Standard # 10.1 Introduction to organic chemistry: structure, properties, and nomenclature	The student will be able to: • Name simple alkanes, alkenes, and alkynes. • Discuss isomerism in organic molecules.	Zumdahl ch. 22 pgs. 1034-1048 Morrison and Boyd ch 1 pgs 1-39 Lab: Introduction to Organic Compounds Lab: Structural Formulas and Isomerism	10 days	1,2,3,4,5

	• Recognize basic organic functional groups. •	Lab: Melting Point Video: Carbon		
Learning Standard # 10.2 Alkanes(Methane), hydrocarbons and functional groups, nomenclature	The student will be able to: • Name simple alkanes. • Recognize basic organic functional groups. •	Morrison and Boyd ch 2 and 3 pgs 40-114 Lab: Distillation	4 days	1,2,3,4, 5
Learning Standard # 10.3 Alkenes, structure and preparation	The student will be able to: • Name simple alkenes • Discuss isomerism in alkenes. •	Morrison and Boyd ch 5 143-147 Lab: Cis-Trans Isomerism	3 days	1,2,3,4, 5
Learning Standard # 10.4 Benzene, aromatic character and functional groups	The student will be able to: • Name benzene and its common derivatives. • Discuss isomerism in benzene derivatives. • Recognize basic organic functional groups associated with benzene. •	Morrison and Boyd ch 10 pgs 318-336 Lab: Recrystallization Video: Proteins-Structure and function	4 days	1,2, 3,4, 5
Learning Standard # 10.5 Electrophilic aromatic substitution	The student will be able to: • Name simple substituted benzene derivatives. • Discuss preparation of benzene derivatives. •	Morrison and Boyd ch 11 pgs 337-37 Lab: Sulfonation Video: Age of Polymers	4 days	1,2, 3, 4, 5
Learning Standard # 10.6 Alcohols, structure and physical properties	The student will be able to: • Name simple alcohols • Discuss preparation of alcohols. • Discuss isomerism in alcohols	Morrison and Boyd ch 15 pgs 492-517 Lab: Reactions of Alcohols Video: Organic Chemistry-Standard Deviants series 1-3	4 days	1,2, 3,4, 5

Learning Standard # 11 Descriptive chemistry				
Learning Standard # 11.1 Chemical reactivity and products of chemical reactions	The student will be able to: • Predict the products of chemical reactions. • Write complete, balanced chemical equations for chemical reactions.	Lab: Predicting Chemical reactions Masterton ch. 4 pgs. 90-102	4 days	1,2, 3,4, 5
Learning Standard #11.2 Sources of the elements	The student will be able to: • Discuss the sources and preparation of common elements.	Masterton ch. 4 pgs.103-114 Video: Chemistry of the Earth	3 days	1,2,3,4,5,6
Learning Standard #11.3 The atmosphere	The student will be able to: • Explain the fixation of nitrogen to form ammonia (Haber process) and the conversion of ammonia to nitric acid (Ostwald process). • Discuss the effect of water and carbon dioxide upon our weather and climate. • Write photochemical reactions taking place in the upper atmosphere • Explain the sources, effects, and treatment of air pollution by sulfur oxides, sulfuric acid, carbon monoxide, and nitrogen oxides.	Masterton ch. 17 pgs.515-540	3 days	1,2,3,4,5,6
Learning Standard # 12 Laboratory		All of the labs listed above pertain to this standard. Students keep a laboratory notebook of all their labs		
Learning Standard # 12.1 Making observations of chemical reactions and substances	The student will be able to: • Observe chemical reactions in the laboratory.	All labs	Continual	1,2, 3,4, 5
Learning Standard # 12.2 Recording data	The student will be able to: • Record accurate and precise data.	All labs	Continual	1,2, 3,4, 5
Learning Standard # 12.3	The student will be able to:	All labs	Continual	1,2, 3,4, 5

Calculating and interpreting results based on the quantitative data obtained	• Perform calculations describing laboratory experiments. • Interpret the data and calculations of an experiment to reach conclusions about that experiment.			
Learning Standard # 12.4 Communicating effectively the results of experimental work	The student will be able to: • Write a conclusion summing up the laboratory results and explaining the chemical implications of an experiment.	All labs	Continual	1,2, 3,4, 5