

Chemistry: Grades 11 & 12				
Learning Standards	Objectives	Resources	Time Allotment	SHS Student Expectations
Learning Standard #1 Metric measurements				
Learning Standard # 1.1 Metric system	The student will be able to: <ul style="list-style-type: none"> • practice metric manipulations and conversions with reasonable accuracy and precision. • develop familiarity with and use terms associated with metric measurements. • develop an awareness of metric use in their everyday lives. • recognize why scientists prefer metric measurements over U.S. customary units. 	Video: The Scientific Method Lab Safety Skill Handbook: ch. 1 pgs. 1-12 Lab: Chemical and Physical properties Demo: Fe + S	6 days	1,2, 3,4, 5
Learning Standard # 2 Water				
Learning Standard # 2.1 Water quality	The student will be able to: <ul style="list-style-type: none"> • explore the role of water in their own lives. • develop an awareness of the quantity of water routinely used by themselves and their families. • develop an awareness of the quantity of water used in the 	Heikkinen: ch. 1 pgs. 4 -21 Heikkinen: ch 2 pgs 22-41 Lab: Foul Water Lab: Water Testing	5 days	1,2, 3,4, 5, 6

	<ul style="list-style-type: none"> manufacturing of goods. collect and discuss data about the lack of adequate water in drought stricken areas of the world. become familiar with the terms: symbol, formula, equation, element, and compound. develop an understanding of the necessity of water purification and treatment in our society. recognize the use of chemistry as it applies to real world problems. 			
Learning Standard # 2.2 Chemistry of Water	The student will be able to: <ul style="list-style-type: none"> learn more about the chemistry of water and how substances interact with it. recognize the observable properties of matter and how they relate to water. develop an understanding of the molecular idea of matter based on atoms and molecules. become familiar with the naming, structure, and chemistry of ionic and molecular substances. develop an understanding of the concepts related to solubility: solute, solvent, solution, saturation, and solubility curves. 	Transparencies: Riverwood Map Video :Water Heikkenin: ch. 3 pgs. 45 – 65 Heikkenin: ch. 4 pgs. 69 -89 Lab: Constructing a Solubility Curve Lab: Solvents Lab: Water Softening	10 days	1,2, 3,4, 5
Learning Standard # 3 Chemical Resources				
Learning Standard # 3.1	The student will be able to:	Heikkenin: ch. 5 pgs 94 - 108	6 days	1,2,3,4,5

Chemical equations	<ul style="list-style-type: none"> • develop familiarity with the law of conservation of matter through the use of balanced equations. • engage in balancing chemical equations. • recognize the difference between exothermic and endothermic reactions. • distinguish between renewable and nonrenewable resources. • recognize the importance of organizing chemical knowledge through the study and use of the periodic table. • recognize the difference between physical and chemical properties of matter. • distinguish between metallic and nonmetallic elements by use of some physical and chemical characteristics. • demonstrate an understanding that patterns and regularities in nature are used to organize chemical information through the use of activities associated with the periodic table of elements. 	Lab: Metal or non metal? Lab: Retrieving Copper		
Learning Standard # 3.2 Periodic table	The student will be able to: <ul style="list-style-type: none"> • use the periodic table to identify families (groups), periods, valence electrons and reactivity with other elements 	Heikkenin: ch. 5 pgs 140-154 Lab: Periodic Table Lab: Copper plating	4 days	1,2,3,4,5

	<ul style="list-style-type: none"> relate the position of an element on the periodic table to its electron configuration use the periodic table to identify metal, nonmetals, and metalloids explore the reactivity of elements and question what causes differences in reactivity. explore the reactivity of elements and question what causes differences in reactivity. 			
Learning Standard # 3.3 Mole Concept	<p>The student will be able to:</p> <ul style="list-style-type: none"> investigate the concepts of the mole, molar mass, and molarity 	Heikkenin: ch. 5 pgs 140 Lab: Mole/mass	4 days	1,2,3,4,5
Learning Standard # 3.4 Chemical resources	<p>The student will be able to:</p> <ul style="list-style-type: none"> explore the Earth's chemical supplies, where they are located, how society uses them, how nature conserves them, and what conservation means in human terms. evaluate the economic, political, and environmental effects of recycling and decide which resources are better candidates for recycling. 	Heikkenin: ch. 5 pgs 140 Lab: Converting Copper Lab: Relative reactivities of metals	6 days	1,2,3,4,5
Learning Standard # 4 Petroleum Chemistry				
Learning Standard # 4.1 Petroleum products	<p>The student will be able to:</p> <ul style="list-style-type: none"> develop an awareness of the wide array of everyday items made from petroleum that we rely on investigate the properties and 	Heikkenin: ch. 6 pgs 161-169 Lab: Separation by distillation Lab: Modeling Alkanes	6 days	1,2,3,4,5

	<p>chemistry of petroleum and carbon based chemistry.</p> <ul style="list-style-type: none"> investigate the fractional distillation of petroleum and realize that boiling points are important in distillation. develop a familiarity with the terms covalent bond and ionic bond and realize that hydrocarbon molecules form as a result of covalent bonding. develop an understanding that organic chemistry is so extensive relative to inorganic chemistry because of the unique bonding capability of carbon. recognize that lifestyles were very different before the use of petroleum and that the Industrial Revolution brought accelerated use of petroleum. 			
<p>Learning Standard # 4.2 Energy sources and uses</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> identify the sun as the primary source of energy trace the growth of energy use and associate it with economic factors and with the availability of particular types of energy sources explore the chemical energy stored in molecules through the use of exothermic and endothermic chemical reactions construct models of hydrocarbons and explore common petroleum based molecules and their typical reactions. 	<p>Heikkinen: ch. 6 pgs 181-199 Lab: Molecular Model kit Lab: Combustion Lab: Condensation Video: Chemical Bonds</p>	<p>10 days</p>	<p>1,2,3,4,5</p>

	<ul style="list-style-type: none"> • explore the alternatives we can turn to if we run out of oil. 			
Learning Standard # 5 Food Chemistry				
Learning Standard # 5.1 Energy from food	<p>The student will be able to:</p> <ul style="list-style-type: none"> • compare the uses of food in terms of “building” and “burning”. • distinguish malnutrition from undernutrition, and identify parts of the world where these problems are most acute. • define calorie and joule, and calculate energy changes from calorimetry data • correlate weight gain or loss with caloric intake and human activity.. 	Heikkenin: ch. 9 pgs 275-294 Lab: Energy contained in a snack	5 days	1,2,3,4,5
Learning Standard # 5.2 Functional groups	<p>The student will be able to:</p> <ul style="list-style-type: none"> • compare and contrast mono-, di, and poly- saccharides in terms of structural formulas and properties • distinguish between saturated and unsaturated fats, and relate the consumption of each to health describe how functional groups in amino acids interact in protein formation. • describe how functional groups in amino acids interact in protein formation. describe five functions of proteins in the body • describe five functions of proteins in the body • explain the concepts of essential 	Heikkenin: ch. 8 pgs 256-264 Lab: Enzymes Lab: Amylase tests	10 days	1,2,3,4,5

	<p>amino acids, complete protein, and complementary protein with respect to a balanced die</p> <ul style="list-style-type: none"> distinguish water-soluble from fat-soluble vitamins, and discuss the implications of these differences in terms of dietary needs analyze the vitamin C content of foods by performing titrations 			
<p>Learning Standard # 5.3</p> <p>Food safety</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> recognize the relative risks and benefits of various food additives in terms of their purposes, and provide specific example explain the role of the Food and Drug Administration and federal regulations in ensuring food safety compare and contrast menus from several cultures in terms of calories and nutritional balance, and analyze the nutritional quality of food recorded in a personal food diary 	<p>Heikkenin: ch. 3 pgs 75-85 Lab: Vitamin C Lab: Food coloring analysis</p>	<p>7 days</p>	<p>1,2,3,4,5</p>
<p>Learning Standard # 6</p> <p>Nuclear Energy</p>				
<p>Learning Standard # 6.1</p> <p>Nuclear technology</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> list at least three examples of nuclear technology and/or natural radioactivity that affect dairy life. explain the general properties of electromagnetic radiation and specific properties of various regions of the electromagnetic spectrum. 	<p>Lab Alpha, Beta, and Gamma radiation Lab: Cloud chamber Heikkenin: ch. 11 pgs. 340-346</p>	<p>6 days</p>	<p>1,2,3,4,5</p>

	<ul style="list-style-type: none"> describe the experiments of Roentgen, Becquerel, the Curies, and Rutherford, and explain how they led to modifications in the atomic model. describe radiation detectors and their operating principles. identify the main components of a nuclear power plant. assess relative risks and benefits of various nuclear technologies. 			
Learning Standard # 6.2 Nuclear chemistry	The student will be able to: <ul style="list-style-type: none"> describe the properties and locations of the three major subatomic particles e. define the term isotope and interpret nuclear isotope notation. define the term isotope and interpret nuclear isotope notation. balance nuclear equations and use them to describe natural radioactive decay. define nuclear transmutation using a nuclear equation to illustrate the process distinguish nuclear fission from nuclear fusion use the equation $E=mc^2$ to compare the energies produced by nuclear fission and by typical exothermic chemical reactions. explain the energy effects of a chain reaction and compare a controlled and an uncontrolled reaction. 	Heikkinen: ch. 10 pgs. 322-325	8 days	1,2,3,4,5
Learning Standard # 6.3 Radiation	The student will be able to: <ul style="list-style-type: none"> explain the concept of half-life 	Heikkinen: ch. 10 pgs. 303-306	5 days	1,2,3,4,5

	<p>and discuss the implications of half-life for natural radioactivity and nuclear waste disposal</p> <ul style="list-style-type: none"> • list and briefly explain factors that determine the amount of biological radiation damage. compare the ionizing radiation produced by various sources, including radon, that are encountered by a typical United States citizen • compare the ionizing radiation produced by various sources, including radon, that are encountered by a typical United States citizen. • explain the problems and possible solutions associated with nuclear waste generation and disposal. 	Lab: Dart analogy		
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Learning Standard # 7 Chemistry of the Atmosphere				
Learning Standard # 7.1 Atmosphere	<p>The student will be able to:</p> <ul style="list-style-type: none"> • describe common physical and chemical properties of air. • compare the chemical properties of nitrogen, oxygen, and carbon dioxide. • identify the major components of the troposphere and indicate their relative concentrations. • sketch or graph the relationship between altitude and air pressure. • explain how differing heat capacities and reflectivity of various land covers and water can influence local climates. 	<p>Heikkenin: ch. 13 pgs. 395-406 Lab: Exploring properties of gases Lab: Temperature/volume relationships Lab: Making acid rain</p>	10 days	1,2, 3,4, 5

	<ul style="list-style-type: none">• describe the greenhouse effect, its natural incidence and causes, and the significance of industrial contributions.• compare the production of carbon dioxide from combustion with that from respiration.• describe the function of the ozone layer and how human activities may be affecting it.• list the major categories of air pollutants and discuss the relative contributions of various human and natural factors to each category.• describe the major general strategies for controlling pollution and specific strategies for particulates.• describe chemical reactions and geographic and meteorological factors which contribute to photochemical smog.• interpret graphs and tables related to automotive induced air pollution.• describe the role of catalytic converters in reducing automotive emissions of unburned hydrocarbons, carbon monoxide, and nitrogen oxides.• describe sources and consequences of acid rain.• define the terms acid and base, give examples of each, describe their formation with balanced ionic equations, and relate			
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	<p>hydrogen ion concentration to the pH scale.</p> <ul style="list-style-type: none"> • discuss air pollution in terms of the trade off between control cost and damage cost. 			
<p>Learning Standard # 7.2 Gas laws</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> • describe with words and equations the interrelationships among amount, temperature, volume, and pressure (Avogadro's, Charles', and Boyle's laws), and list one practical application of each law • define and apply in appropriate situations the terms molar volume, standard temperature and pressure (STP), Kelvin temperature scale, and absolute zero. • discuss air pressure and explain how to measure it. 	<p>Heikkenin: ch. 13 pgs. 401-405 Lab: Carbon dioxide levels Lab: Specific heat capacity</p>	6 days	1,2, 3,4, 5
<p>Learning Standard # 7.3 Solar energy</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> • compare the various components of solar radiation. • predict possible products for ionic equations of precipitation reactions in aqueous solutions. • describe how reflection, absorption and re-radiation of solar radiation account for the Earth's energy balance. 	<p>Heikkenin: ch. 14 pgs. 425-435 Lab: Cleansing air</p>	6 days	1,2, 3,4, 5
<p>Learning Standard # 8 Human Body Chemistry</p>				
<p>Learning Standard # 8.1 Major elements of the human body</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> • develop examples of 	<p>Heikkenin: ch. 14 pgs. 453-471 Lab: Titration</p>	10 days	1,2, 3,4, 5

	<p>correlation and determine the relationship between the members of a given pair of events.</p> <ul style="list-style-type: none"> • define epidemiology, and describe benefits and limitations of epidemiological studies. • define homeostasis and give examples of how it is related to maintaining good health. • describe the major elements of the human body and their function in maintaining good health. • explain how enzymes work and list several factors that may alter their effectiveness. • describe cellular energy production and storage, including the role of ATP • define and give examples of acids and bases, and use net ionic equations to describe the neutralization reaction. • describe the components of a buffer and explain how it prevents acidosis and alkalosis. • describe the concept of “like dissolves like” and apply it to the function of soap. • explain the functions of the different skin parts and describe the effect of sunlight on these parts and the effectiveness of sun screens. 			
<p>Learning Standard # 8.2 Drugs</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> • explain the effect of common 	<p>Heikkinen: ch. 14 pgs. 471-475 Lab: Titration of vinegar Lab: Preparation of Soap</p>	<p>10 days</p>	<p>1,2, 3,4, 5,6</p>

	<p>drugs on the human body, and the body's chemical defenses against these drugs.</p> <ul style="list-style-type: none"> • discuss the role of antigen-antibody complexes in protecting the body against infectious organisms, and contrast the Aids virus to other viruses. • evaluate the products of cigarette smoking and assess personal control of risks to maintain good health and well being. 			
<p>Learning Standard # 9 Chemistry in Industry</p>				
<p>Learning Standard # 9.1 Positive and negative effects</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> • list the functions of the chemical industry and the general categories of industrial products, both present and future. • contrast responsibilities of the public and industry in preserving the quality of life in a community • . evaluate the potentially positive and negative impacts of a chemical industry on a community. • analyze a fertilizer sample for its major components, and describe their importance in agriculture. • develop and evaluate voltaic cells, using the activity series of common metal. 	<p>Heikkenin: ch. 13 pgs. 395-406 Lab: Fertilizer components Lab: Phosphates</p>	<p>8 days</p>	<p>1,2,3,4,5</p>

	<ul style="list-style-type: none"> demonstrate the charging and discharging of electrochemical cells and the technique of electroplating. identify key considerations involved in the development of a new chemical process or product. 			
Learning Standard # 9.2 Chemical engineers	The student will be able to: <ul style="list-style-type: none"> compare natural and synthetic products, providing examples of each. describe the role of chemical engineers in industry. explain the major divisions and departments of a typical chemical industry, and explain their interrelationships. 	Heikkenin: ch. 18 pgs. 553-566 Lab: LeChatelier's Principle	5 days	1,2, 3,4, 5
Learning Standard # 9.3 History of chemistry in industry	The student will be able to: <ul style="list-style-type: none"> describe the process of nitrogen fixation in the Haber process. trace the history and development of explosives, including the contributions of Alfred Nobel. 	Heikkenin: ch. 17 pgs. 531-540 Video: Driving Forces Lab: Voltaic cells	6 days	1,2,3,4,5
Learning Standard # 10 Laboratory		All of the labs listed above pertain to this standard. Students keep a laboratory notebook of all of their labs.		
Learning Standard # 10.1 Making observations of chemical reactions and substances	The student will be able to: <ul style="list-style-type: none"> Observe chemical reactions in the laboratory. 	All labs	Continual	1,2, 3,4, 5
Learning Standard # 10.2 Recording data	The student will be able to: <ul style="list-style-type: none"> Record accurate and precise data. 	All labs	Continual	1,2, 3,4, 5
Learning Standard # 10.3 Calculating and interpreting results based on the quantitative data obtained	The student will be able to: <ul style="list-style-type: none"> Perform calculations describing laboratory experiments. 	All labs	Continual	1,2,3,4, 5

	<ul style="list-style-type: none"> Interpret the data and calculations of an experiment to reach conclusions about that experiment. 			
<p>Learning Standard # 10.4 Communicating effectively the results of experimental work</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> Write a conclusion summing up the laboratory results and explaining the chemical implications of an experiment. 	All labs	Continual	1,2, 3,4, 5