



Ganado Unified School District (CHEMISTRY I/Grade 11th and 12th)

PACING Guide SY 2019-2020

Timeline & Resources	AZ College and Career Readiness Standard/ AZ 2018 Science Standards	Essential Question (HESS Matrix)	Learning Goal	Vocabulary (Content/Academic)
Quarter 1 Inquiry Process	Strand 1: Inquiry Process Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources. PO 1. Evaluate scientific information for relevance to a given problem. (See R09-S3C1, R10-S3C1, R11-S3C1, and R12-S3C1) PO 2. Develop questions from observations that transition into testable hypotheses. PO 3. Formulate a testable hypothesis. PO 4. Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring). Concept 2: Scientific Testing (Investigating	What are the different science process skills? What is a hypothesis? What are the steps of the scientific method? How does dependent and independent variable differ? How do we identify them in the scientific inquiry process?	I will be able to: <ul style="list-style-type: none"> • Make hypotheses, predictions and observations using the scientific inquiry • Design an investigation • Identify dependent and independent variables • Interpret graphs, tables and charts and analyze them • Make inferences and conclusions • Apply mathematical/ statistical skills in manipulating data and interpreting them 	Test tube Beaker Dependent variable Independent variable Graphs-legend, axis, key, positive relationship negative relationship no relationship Hypothesis Results Data Constants control Accuracy Precision Frequency Mean Theory Observe inference Predict, Percentage

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	<p>and Modeling)</p> <p>Design and conduct controlled investigations.</p> <p>PO 1. Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.</p> <p>PO 2. Identify the resources needed to conduct an investigation.</p> <p>PO 3. Design an appropriate protocol (written plan of action) for testing a hypothesis:</p> <ul style="list-style-type: none"> • Identify dependent and independent variables in a controlled investigation. • Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes). • Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators). <p>PO 4. Conduct a scientific investigation that is based on a research design.</p> <p>PO 5. Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.</p>			

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	<p>Concept 3: Analysis, Conclusions, and Refinements</p> <p>Evaluate experimental design, analyze data to explain results and propose further investigations.</p> <p>Design models.</p> <p>PO 1. Interpret data that show a variety of possible relationships between variables, including:</p> <ul style="list-style-type: none"> • positive relationship • negative relationship • no relationship <p>PO 2. Evaluate whether investigational data support or do not support the proposed hypothesis.</p> <p>PO 3. Critique reports of scientific studies (e.g., published papers, student reports).</p> <p>PO 4. Evaluate the design of an investigation to identify possible sources of procedural error, including:</p> <ul style="list-style-type: none"> • sample size • trials • controls • analyses <p>PO 7. Propose further investigations based on the findings of a conducted investigation.</p>			

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	<p>Concept 4: Communication Communicate results of investigations.</p> <p>PO 1. For a specific investigation, choose an appropriate method for communicating the results. (See W09-S3C2-01 and W10-S3C3-01)</p> <p>PO 2. Produce graphs that communicate data. (See MHS-S2C1-02)</p> <p>PO 3. Communicate results clearly and logically.</p> <p>PO 4. Support conclusions with logical scientific arguments.</p>			
History and Nature of Science	<p>Strand 2: History and Nature of Science</p> <p>Sci. 2.1 PO1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.</p> <p>Sci. 2.1 PO3. Analyze how specific changes have affected society.</p> <p>Sci. 2.1 PO4 Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.</p>	<p>What is Chemistry?</p> <p>What are the branches of Chemistry?</p> <p>How does Chemistry affect human life?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> define Chemistry identify the branches of Chemistry identify the advancements in Chemistry explain how Chemistry is applied in daily living identify application of Chemistry in homes, industries and environment 	<p>Innovation</p> <p>Chemistry</p> <p>Pure science</p> <p>Applied science</p> <p>Valid, scientific explanation (theory)</p> <p>Investigate</p> <p>Element</p> <p>Chemical</p> <p>Chemist</p>
Chemistry: The Science of Matter	<p>Sci 5.1 PO1. Describe substances based on their physical properties.</p>	<p>How is matter classified according to its composition?</p>	<p>I will be able to:</p>	<p>chemistry</p> <p>matter</p> <p>mass</p>

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Matter and Change	<p>Sci 5.1 PO2. Describe properties based on their chemical properties.</p> <p>11-12.RST.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.</p> <p>11-12.WHST.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p>	<p>How are elements, compounds, mixtures different?</p> <p>How does the structure of matter relate to its properties?</p> <p>What are physical and chemical properties?</p> <p>How do chemical and physical changes differ?</p> <p>How does the law of conservation of matter apply to chemical changes?</p>	<p>-define chemistry as it relates to the classification of matter and changes of state.</p> <p>-compare and contrast elements, compounds, and mixtures.</p> <p>-identify two types of mixtures.</p> <p>-explain how a pure substance is different from a mixture.</p> <p>-define physical and chemical properties and changes.</p>	<p>property</p> <p>scientific model</p> <p>qualitative</p> <p>quantitative</p> <p>substance</p> <p>mixture</p> <p>alloy</p> <p>solute</p> <p>solvent</p> <p>aqueous solution</p> <p>element</p> <p>compound</p> <p>formula</p>
Matter is Made of Atoms	<p>Sci. 5.1 PO7. Describe the historical development of models of the atom.</p> <p>11-12.RST.2 Determine central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.</p> <p>11-12.WHST.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p>	<p>How have historic experiments led to the development of the modern model of the atom?</p> <p>How is the modern model of an atom different from previous models?</p> <p>What information is available in an element block of the periodic table?</p> <p>How does the electron relate to modern atomic theory?</p>	<p>I will be able to:</p> <p>-discuss the timeline which led to the development of the modern atomic theory.</p> <p>-investigate experimental evidence and contributions of influential scientists including Lavoisier, Proust, Dalton, Thomson, and Rutherford.</p> <p>-describe the electromagnetic spectrum and how it relates to elemental emission spectra.</p>	<p>atom</p> <p>atomic theory</p> <p>law of definite proportions</p> <p>hypothesis</p> <p>theory</p> <p>scientific law</p> <p>atomic mass unit</p> <p>electromagnetic spectrum</p> <p>emission spectrum</p> <p>energy level</p> <p>electron cloud</p> <p>valence electron</p> <p>Lewis dot diagram</p>

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		How do electron energy levels in an atom differ from one another? How are Lewis dot diagrams used to illustrate valence electrons?	-investigate valence electron structure and describe procedures for drawing Lewis dot diagrams.	
Introduction to the Periodic Table	Sci 5.1 PO3. Predict properties of elements and compounds using trends of the periodic table (e.g. metals, non-metals) <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Essential HS.P1U1.1 Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed in the Periodic Table and describe how these models are revised with new evidence. </div>	What are the steps in the historical development of the periodic table? How is the periodic table used to predict similarities in properties of the elements? How does an element's valence electron structure relate to its position in the periodic table? How is the periodic table used to classify an element as a metal, nonmetal, or metalloid? What are the properties of metals, nonmetals, and metalloids?	I will be able to: -explain the structure of the periodic table. -compare the properties of metals, nonmetals, and metalloids with the number of their valence electrons. -discuss the use of metalloids in semiconductors.	period periodicity periodic law noble gas transition element lanthanide actinide metalloid semiconductor
Periodic Properties of the Elements	5.1 PO 1. Describe substances based in their physical properties.	How does the position of main group elements on the periodic table relate to their electron configuration?	I will be able to: -discuss the properties of the main group elements and how they relate to electron configuration and atomic size.	Alkali metal Alkaline earth metal Halogens

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	5.1 PO 8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes).	How does an element's electron configuration and atomic size relate to its chemical behavior? What are the chemical behaviors of transition elements in the periodic table?	-examine the properties of several of the most important transition elements in group 3-12 and relate them to their electron configurations. -discuss how the inner transition elements are characterized by f sublevels, and describe a few of the most important elements	
Formation of Compounds	Sci 5.1 PO3. Predict properties of elements and compounds using trends of the periodic table (e.g. bonding-ionic/covalent) <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Essential HS.P1U1.2 Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes. </div>	How are the properties of compounds different from those of the elements of which the compounds are composed? In what ways are the properties of sodium chloride, water, and carbon dioxide similar? How are they different? How can the formation of ionic and covalent compounds be modeled at the submicroscopic level? How do atoms achieve chemical stability by bonding? How do the physical properties of covalent	I will be able to: -relate the formation of ionic and covalent compounds to the submicroscopic structure of the constituent elements. -discuss the general characteristics of ionic and covalent compounds and relate them to the type of bonding.	octet rule noble gas configuration ion ionic compound ionic bond crystal covalent bond covalent compound molecule electrolyte interparticle force

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		compounds compare to those of ionic compounds?		
Types of Compounds	Sci 5.1 PO5. Describe the properties of electrical charge and the conservation of electric charge.	<p>If charges of ions are known, how can proper formulas be written for ionic compounds?</p> <p>How can the formula of an ionic compound be determined from the name for the compound?</p> <p>What kind of information can be gathered from a chemical formula?</p> <p>How do the properties of covalent substances compare with those of ionic substances?</p> <p>How can a formula of a covalent compound be used to generate a name for the compound?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> -define the rules for writing formulas and naming ionic compounds. -explain how to interpret chemical formulas and relate them to the individual charges of ions combining within the compound. -compare and contrast ionic and covalent compounds. -identify the rules to follow in naming binary compounds, common acids and bases, and hydrocarbons. 	binary compound formula unit oxidation number polyatomic ion hydrate hygroscopic deliquescent anhydrous distillation molecular element allotrope organic compound inorganic compound hydrocarbon
Quarter 2 Chemical Equations and Reactions	<p>Sci 5.4 PO3. Represent a chemical reaction by using a balanced equation.</p> <p>Sci 5.4 PO9. Predict the products of a chemical reaction using types of reactions (e.g. synthesis, decomposition, replacement, combustion).</p>	<p>How do chemical equations describe chemical reactions?</p> <p>How are chemical reactions balanced by changing coefficients?</p> <p>How are the five major types of chemical reactions classified?</p> <p>What factors influence the direction of a reaction?</p>	<p>I will be able to:</p> <ul style="list-style-type: none"> -use the law of conservation of mass to write and balance chemical equations. -describe the five reaction types in detail and identify examples of each type. -investigate the reactants and products for each of these reactions and emphasize how they can be used to interpret the reaction. 	reactant product coefficient synthesis decomposition single displacement double displacement combustion equilibrium soluble insoluble

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			<ul style="list-style-type: none"> -define reversible reaction and relate this concept to equilibrium -discuss Le Chatelier's principle and the driving force behind chemical change. 	activation energy catalyst enzyme inhibitor
Completing the Model of the Atom	5.1 PO 7. Describe the historical development of models of the atom. 5.1 PO 8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes) <div> Plus HS+C.P1U1.1 Develop and use models to demonstrate how changes in the number of subatomic particles (protons, neutrons, electrons) affect the identity, stability, and properties of the element. </div>	How do emission spectra relate to the electron configurations of atoms? What are the energy sublevels and orbitals within an atom? Where are the s, p, d, and f blocks on the periodic table and how do they relate to an element's electron configuration?	I will be able to: <ul style="list-style-type: none"> -describe the evidence that led to current theories about atomic structure, and relate this evidence to the distribution of electrons in energy levels, sublevels, and orbitals. -explain the correlation between the electron configuration of the elements, the organization of the periodic table, and the periodicity of chemical properties. -relate characteristics of the noble gases and transition elements to their electron arrangements. -discuss relative orbital sizes. 	sublevel aufbau principle Heisenberg uncertainty principle orbital electron configuration
Chemical Bonding	5.1 PO 3. Predict properties of elements and compound using trends of the periodic table (e.g., metals, non-metals, bonding – ionic/covalent). <div> Plus HS+C.P1U1.4 Develop and use models to predict and explain forces within and between molecules. </div>	How are ionic, covalent, and polar covalent bonds similar? How are they different? How can a Lewis dot diagram be used to formulate the three-dimensional geometry of a molecule?	I will be able to: <ul style="list-style-type: none"> -define electronegativity as a key to differentiate between covalent, polar covalent, and ionic bonds. -examine Lewis dot diagrams of molecules and analyze electron-pair repulsions in order to determine molecular geometries and polarities. 	electronegativity shielding effect polar covalent bond malleable ductile conductivity metallic bond double bond triple bond polar molecule

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			-discuss properties of covalent compounds and compare it to the properties of ionic compounds.	
The Kinetic Theory of Matter	5.5 PO 4. Describe the basic assumptions of kinetic molecular theory. <div style="border: 1px solid black; padding: 5px;"> Plus HS+C.PIU1.3 Analyze and interpret data to develop and support an explanation for the relationships between kinetic molecular theory and gas laws. </div>	What are the characteristics of a solid, liquid, and gas? How are changes in temperature and changes in temperature and state of a substance explained in terms of the kinetic theory of matter? How do temperature and pressure affect changes of state?	I will be able to: -examine the characteristics of solids, liquids, and gases and the changes between these physical states. -relate the changes between physical states to the kinetic theory of matter. -explain that temperature is a measure of the average kinetic energies of particles.	Brownian motion Kinetic theory of matter ideal gas pressure crystal lattice amorphous solid liquid crystal absolute zero vapor pressure boiling point
Quarter 3 Behavior of Gases	5.5 PO 5. Apply kinetic molecular theory to the behavior of matter (e.g., gas laws)	How does kinetic theory explain the effects of changing the mass, temperature, pressure, and volume of a gas? How are temperature, pressure, and volume of	I will be able to: -relate gas pressure to volume, temperature, and the number of gas particles. -define units of pressure -express and define the behavior of gases using Boyle's law, Charles's	barometer standard atmosphere Pascal Boyle's law Charles's law Combined gas law Standard temperature
		a gas related?	law, and the combined gas law.	and pressure (STP)
Chemical Quantities	5.4 PO 5. Describe the mole concept and its relationship to Avogadro's number. 5.4 PO 6. Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and	How is the mole a counting number? How are stoichiometric problems solved using molar mass? How are quantities of reactants and products predicted in chemical reactions?	I will be able to: -express large numbers using Avogadro's constant, mole concept, and molar masses. -calculate theoretical yield, actual yield, percent yield of compounds.	stoichiometry mole Avogadro's number molar mass molecular mass formula mass molar volume ideal gas law

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	molarity using mole concept and Avogadro's number. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Plus HS+C.P1U1.7 Use mathematics and computational thinking to determine stoichiometric relationships between reactants and products in chemical reactions. </div>	How are mole ratios determined from formulas for compounds?		theoretical yield percent yield
Acids, Bases, and pH	5.4 PO 12. Compare the nature, behavior, concentration, and strengths of acids and bases.	What properties distinguish acids from bases? How do strong acids and bases compare to weak acids and bases in terms of degree of dissociation or ionization? How is pH related to the acidity of a solution?	I will be able to: -explore the properties of acids and bases and relate their reactions in water. -explain the difference between strong and weak acids and bases and related to the degree of ionization or dissociation of the compounds. -learn about the pH scale and relate to the concentrations of hydronium and hydroxide ions.	acid hydronium ion acidic hydrogen ionization base acidic anhydride basic anhydride strong base strong acid weak acid weak base pH
Acids and Bases React	5.4 PO 12. Compare the nature, behavior, concentration, and strengths of acids and bases.	What is the difference between an overall, an ionic, and a net equation for an acid-base reaction? How is an acid-base titration performed? How can the data from an acid-base titration be	I will be able to: -examine strong acid-strong base, strong acid-weak base, weak acid-strong base, and weak acid-weak base neutralization reactions. -represent each type by writing molecular, ionic, and net ionic equations for the reactions.	neutralization reaction salt ionic equation spectator ion net ionic equation Bronsted-Lowry model

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		used to calculate the concentration of an unknown sample?	-explain the hydrogen-ion transfer definitions of acids and bases.	
Quarter 4 Oxidation – Reduction Reactions	5.4 PO 13. Determine the transfer of electrons in oxidation/reduction reactions.	What are the defining characteristics of an oxidation-reduction reaction? How can you identify the substance being oxidized in a redox reaction? How can you identify the substance being reduced? What are some redox reactions that take place in living cells?	I will be able to: -define oxidation-reduction reactions and identify characteristics of these reactions.	oxidation reduction oxidizing agent reducing agent
Electro chemistry	5.3 PO 1. Describe the following ways in which energy is stored in a system: mechanical, electrical, chemical, nuclear.	How is the construction of a voltaic cell related to the way it produces a voltage and electric current? How do electrons move in a voltaic cell? In what ways do the principles of electrolysis apply to the processes of chemical synthesis, refining, plating, and cleaning?	I will be able to: -examine the electrochemical processes that occur in voltaic cells and batteries. -examine the function of electrolytic cells and identify several applications of electrolysis.	electric current voltaic cell anode cathode potential difference voltage cation anion electrolysis electrolytic cell
Chemical Reactions and Energy	5.4 PO 10. Explain the energy transfers within chemical reactions using the law of conservation of energy.	How are exothermic chemical reactions	I will be able to:	heat law of conservation of energy

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	5.4 PO 11. Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.	<p>similar to endothermic chemical reactions?</p> <p>How are they different?</p> <p>What role does entropy change play in determining whether a process is spontaneous?</p> <p>What are the steps involved in the technique of calorimetry?</p>	<p>-use energy diagrams to examine exothermic and endothermic reactions.</p> <p>-explain activation energy and the effects of catalysts on chemical reactions.</p> <p>-describe entropy as a measure of how dispersed the energy of a system is, and explain how this relates to reaction spontaneity</p>	fossil fuel entropy