Chemistry 431

Unit 1: Properties of Matter
Essential Questions: :
How can properties used to describe matter be classified?
How do physical and chemical properties reflect the nature of the interactions between molecules and atoms?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
1.1 Identify and explain physical properties and chemical properties	1.Distinguish between physical and chemical properties concentrating on Density, Melting Pt, Boiling Pt. 2..Classify change as physical or chemical (demonstrate examples)	1. Modern Chemistry text(Ch 1) 2.Text Review Sheets 3.Power Point (Modern Chemistry)	1.Properties and Classification worksheets 2.Dipsticking 3.Whiteboards 4.Lab Activity: Handling Chemicals 5. Measurement Activity	Homework Assignments Quiz: Properties and Classification of Matter Later Test questions: Matter **Matter Overview Worksheet (CFA)**
1.2 Explain the difference between pure substances and mixtures	1. Distinguish among classes of matter: element, compound, mixture (demonstrate common everyday substances)	1. Modern Chemistry text 2.Text Review Sheets 3.Power Point (Modern Chemistry)	1.Lab Activity: Handling Chemicals 2..Dipsticking 3.Whiteboards	Homework Assignments Quiz: Properties and Classification of Matter **Matter Overview Worksheet** Later Test questions: Matter
1.3 Describe the three common states of matter	1.Explain states of matter (solid, liquid, gas, plasma) in terms of the kinetic molecular model molecule	1. Modern Chemistry text 2.Text Review Sheets 3.Power Point (Modern Chemistry)	1.Compare contrast discussion 2. Dipsticking	Homework Assignments Later Test questions: Matter **Matter Overview Worksheet**

Science Inquiry Skills	**SIS2. Design and conduct scientific investigations.** Articulate and explain the major concepts being investigated and the purpose of an investigation. Select required materials, equipment, and conditions for conducting an experiment. Identify independent and dependent variables. Write procedures that are clear and replicable. Employ appropriate methods for accurately and consistently ○ making observations ○ making and recording measurements at appropriate levels of precision ○ collecting data or evidence in an organized way Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration (if required), technique, maintenance, and storage. Follow safety guidelines.		Introductory Labs: Handling Chemicals OR Bunsen Burner OR Separation of Salt and Sand	Lab Report for Introductory Labs
Mathematical Skills	Determine the correct number of significant figures. Use scientific notation, where appropriate Use appropriate metric/standard, convert within a unit (cm to m) Measure with accuracy and precision		Problem Solving Introductory Labs	Lab Report for Introductory Labs Quizzes
Reading Standards	RST 3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.		Introductory Labs Bunsen Burner or Handling Chemicals or Separation of Salt & Sand	Lab Report
	RST 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.		**Matter Overview Worksheet**	**Matter Overview Worksheet –students will complete independently**

Writing Standards	1. Write arguments focused on *discipline-specific content*. a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented	Rubric: How to write a lab report	Introductory Labs Bunsen Burner or Handling Chemicals or Separation of Salt & Sand	Lab Report for Introductory Labs

Unit 2: Atomic Structure and Nuclear Chemistry
Essential Questions: :
How are atomic models used to explain the interactions of elements and compounds?
What are the key concepts of nuclear chemistry?
What are the main types of nuclear reactions?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
2.1 Recognize discoveries of Dalton (atomic theory) , Thomson (the electron) and Rutherford (nucleus) and understand how these discoveries led to modern theory.	**1.** Recognize discoveries of Dalton (atomic theory) , Thomson (the electron) and Rutherford (nucleus) and understand how these discoveries led to modern theory. **2.** Complete a diagram of the cathode ray tube, with anode, cathode, cathode ray, external magnetic source, and electrical source. Predict the deflection of a cathode ray when in contact with an + electrical field.	1. Modern Chemistry text (Ch 3&4) 2.Text Review Sheets 3. Power Point (Modern Chemistry) diagrams.	1.Compare contrast discussion 2. Dipsticking 3. Diagram drawing or model construction	Homework Assignments Test question(s) later Atomic Structure
2.2 Describe Rutherford's gold foil experiment that led to the discovery of the nuclear atom .	Complete a diagram of the gold foil and alpha ray set up. Predict Rutherford's initial hypothesis. Draw conclusions based on the results of Rutherford's experiment. Nucleus is +, small and dense.	1. Modern Chemistry text 2.Text Review Sheets	Develop a table listing important information about individual atoms	Homework AssignmentsQuiz: Subatomic particle make-up of atoms

	Calculate the # electrons, # neutrons, # protons given the mass number. Using a grid formation.			Test question(s) later
2.3 Interpret and apply the laws of conservation of mass, constant composition (definite proportions) and multiple proportions	Explain Law of Conservation of Mass, Law of Definite Proportions; Summarize essential points of Dalton's Atomic Theory and relate to the above two laws	1. Modern Chemistry text 2.Text Review Sheets	Dipsticking	Test question(s) later
2.4 Write the electron configuration for the first 20 elements of the periodic table	Explain each symbol un an electron configuration Write a configuration for an atom. Identify the type of atom, when given its electron configuration.	1. Modern Chemistry text (Ch 4) 2.Text Review Sheets	Group practice Whiteboard checking	Homework Assignments Quiz: Electron configuration Test question(s) later
2.5 Identify the three main types of radioactive decay (alpha, beta, gamma) and compare their properties (composition, mass, charge, and penetrating power). 2.6 Describe the process of nuclear decay by using nuclear equations, and explain the concept of half-life for an isotope (for example, C-14 is a powerful tool in determiing the age of objects	Write nuclear decay equations for natural decay, and artificial bombardment. Solve half-life problems.	1. Modern Chemistry text(Ch 22) 2.Text Review Sheets 3. Nuclear Self Study Powerpoint (on S- Drive in Chemistry Norton folder) 4. Article: Fukushima Tsunami Disaster www.world-nuclear.org/info/fukushima-accident	Dipsticking Group practice White board checking . WAC: Discuss a nuclear fission chain reaction and how it is controlled in a reactor.	Solve problems with half life equation mass left (R)= $=1/2^{n}$ x S (starting mass) Test question(s) later
2.7 Compare and contrast nuclear fission and fusion	Identify fission vs. fusion nuclear equations.	1. Modern Chemistry text 2.Text Review Sheets	Review worksheet WAC II: Compare and contrast fusion to fission processes	Test question(s) later WAC II: Compare and contrast fusion to fission processes
	SIS1. Make observations, raise questions, and formulate hypotheses. • Observe the world from a scientific perspective.	Nuclear Self-Study-Articles Fukushima Nuclear Disaster links	Independent work in computer lab	WAC I or II

Science Inquiry Skills	• Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge. • Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.	Powerpoint on T - Drive NOVA online April 2012- Hunting The Elements Scientific American Article "The Inner Life of Quarks" November 2012	Read Scientific American article for homework	Written Summary Answer guided questions accompanying Scientific American Article
Mathematics Skills	Construct and use tables and graphs to interpret data sets.	Uranium decay series chart Half-Life Activity	Interpret decay series chart in a guided fashion Graphing half-life of simulated radio-isotope	Lab Report for half-life lab
Reading Standards	RST 4. Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientifific or technical concept.	Nuclear Self-Study on T-Drive (in Chemistry –Norton folder)	Nuclear Self-Directed Study Powerpoint in computer lab	Self-assessment questions on Nuclear Self-Study powerpoint
Writing Standards	WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of	Text description of Ernest Rutherford's Gold-Foil Experiment in the Discovery of the nucleus	WAC- Summarize Ernest Rutherford's Gold Foil Exp't WAC-Summarize The main parts of A nuclear reactor and the function of each part WAC- Compare and	WAC quiz or test question

	the text, create cohesion, and clarify the relationships among complex ideas and concepts. d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).		contrast nuclear fission to nuclear fusion	

Unit 3: Periodicity
Essential Questions:
What are the repeating patterns of physical and chemical properties that occur among the elements of a family/group of the periodic table?
How are these repeating patterns related to the atom's outermost electrons?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
3.1 Explain the relationship of an element's position on the periodic table to its atomic number. Identify the families (groups) and periods of the periodic table	Locate groups and periods on periodic table	1. Modern Chemistry text (Ch 5) 2.Text Review Sheets able projection	Power point projections Blank Periodic Table worksheet Dipsticking	Homework Quiz: Periodic Table
3.2 Use the periodic table to identify the three classes of elemens: metals, nonmetals and metalloids	Identify whether an element is a metal, nonmetal or metalloid. List 4-5 properties of metals vs. nonmetals. Identify the major representative families on periodic table: alkali metals, alkaline earth metals, carbon family, halogens and noble gases. Identify the transition metals (B Groups) along with characteristic properties.	1. Modern Chemistry text 2.Text Review Sheets	Dipsticking	Homework Quiz: Periodic Table

3.3 Relate the position of and element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements on the periodic table	Relate the symbols of electron configuration to the group and period location of a given element. Use the Aufbau Principle/Diagonal Rule to write complete and abbreviated electron confugurations.	1. Modern Chemistry text 2.Text Review Sheets	Group work White board	Quiz: Periodic Table
3.4 Identify trends on the periodic table such atom and ion sizes, ionization energy, and electronegativity	Be able to state and explain the atomic radius trend and ionization energy trend.	1. Modern Chemistry text	Use a blank periodic table to label the direction of periodic trends	Quiz: Periodic Trends
Science Inquiry Skills	**SIS4. Communicate and apply the results of scientific investigations.** Develop descriptions of and explanations for scientific concepts that were a focus of one or more investigations. Review information, explain statistical analysis, and summarize data collected and analyzed as the result of an investigation. Explain diagrams and charts that represent relationships of variables. Construct a reasoned argument and respond appropriately to critical comments and questions. Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (e.g., presentation software) and other tools to present findings. Use and refine scientific models that simulate physical processes or phenomena	Emission Spectra Lab Activity (Gas Emission Tubes and Flame Testing) Aufbau Principle using Diagonal Rule Handout Periodic Table containing Noble Gas Abbreviated electron configurations Dynamic Periodic Table website Vernier Technology	Test emission spectra of elements to support the 1913 Bohr Model of the Atom. Sketch emission spectra data of various elements. Activity: Use the diagonal rule to write electron configurations Activity: Explore on-line Dynamic Periodic Table or APP on Vernier technology to observe, identify and record periodic trends (atomic radius, ionization energy)	Quiz: Electronic Structure and Periodic Table Lab Report Emission Spectra or Flame Test Lab

Reading Standards	RST 2: Determine the 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.	1. Modern Chemistry text (Ch 5)		Read and decipher textual explanations of periodic trends such as atomic radius, ionic radius, ionization energy and electronegativity
Writing Standards	**WHST 2.**Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Modern Chemistry text (Ch 5)	Library Independent Research: Summarize scientific contributions of atomic pioneers (Mendeleev, Dalton, Rutherford, Bohr, Schrodinger) Vernier technology using periodic table APP. Summarize periodic trend of atomic radius and ionization energy	WAC II writing sample- explain a periodic trend such as atomic radius, ionization energy or electronegativity
	WHST 8. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.	Internet Resources: Elements.com Dynamic Periodic Table website Vernier Technology; Perriodic Table APP	Computer Lab Element and Chemical Family Research Project	Student designed Power-point presentation on Chemical Families

Unit 4: Bonding
Essential Questions:
How do atoms bond with each other?
What is the difference between ionic bonding and covalent bonding in terms of behavior of outer electrons?
How do we contrast polar covalent bonding to nonpolar covalent bonding?
How do we draw Lewis dot structures for molecules and polyatomic ions?
What are the basic molecular shapes or geometries predicted by the VSEPR model?

What is a hydrogen bond and how do water molecules adhere together this way?
How are ionic formulas written and how are ionic compounds named?
How are covalent molecular formulas written and how are covalent compounds named using prefix system?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
4.1**:** Explain how atoms combine to form compounds through both ionic and covalent bonding.	Explain ionic bonding. Write formulas and name ionic compounds. Explain covalent bonding. Write formulas and name covalent (molecular)List and compare the distinctive properties of ionic vs molecular compounds. State the octet rule	1. Modern Chemistry text (Ch 4) 2.Text Review Sheets	Group work White board Dipsticking Practice worksheet	Homework Formula and Naming Quiz ionic compounds Formula and Naming Quiz covalent compounds Test questions later
4.2:Draw Lewis dot structures for molecules and ionic compound formula units	Use knowledge of valence electrons to draw Lewis structures for singly bonded molecules, given two elements. Given a molecular formula, draw a Lewis stricture.	1. Modern Chemistry text 2.Text Review Sheets	Group work Dipsticking White board Practice worksheet	Homework Assignments Quiz; Lewis structures Test questions later **CFA: Molecular Model Lab**
4.3**:** Use electronegativity to explain the difference between polar and nonpolar covalent bonds.	Identify bonds as nonpolar covalent, polar covalent based on difference in electronegativity values between the bonded elements.	1. Modern Chemistry text 2.Text Review Sheets	Dipsticking	Test questions later **CFA: Molecular Model Lab**
4.4**:** Use valence shell electron pair repulsion theory (VSEPR) to predict electron geometry (linear, trigonal planar, tetrahedral) of simple molecules.	Predict molecular shapes/geometries: linear, trigonal, tetrahedral, trigonal bipyramidal, pyramidal, and bent/angular based on VSEPR model. Construct basic molecules models to recognize the various geometries. Define molecule	1. Modern Chemistry text 2.Text Review Sheets Chart of Geometries	Molecular Model Common Lab Assessment	Homework Assignments Test questions later **CFA: Molecular Model Lab**
4.5 Identify how hydrogen bonding in water affects a variety	Compare and describe intermolecular forces namely H- bonding, dipole interaction, and dispersion (London) force.	1. Modern Chemistry text 2.Text Review Sheets	Dipsticking Textbook review worksheet	Test questions later

of physical, chemical, and biological phenomena.	Concentrate on the Hydrogen (H) Bond; Explain what determines polarity. Draw 4-5 water molecules and show in detail the interaction		Demonstration: Special Properties of Water	
4.6 Name and write the chemical formulas for simple ionic and molecular compounds	Use prefixes to name a binary molecular compound from the formula. Write the formula of a binary molecular compound given its name Know rules for naming common acids	1. Modern Chemistry text (Ch 7) 2.Text Review Sheets	Worksheet or Practice Quiz- Writing and Naming Chemical Compounds	Quiz- Writing And Naming Chemical Compounds Test questions later
Science Inquiry	SIS4: Use and refine scientific models that stimulate physical processes and phenomena. Explain diagrams and charts that represents relationships of variables. e.g. electronegativity	Magnetic and Ball & Stick Molecular Model Kits VSEPR Chart of molecular geometries	**CFA: Molecular Model Lab**	**CFA: Molecular Model Lab**
Reading Standard**s**	RST 5: Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.	Modern Chemistry text (Ch 6,7)	Computer Lab: View Casseopeia Project (Chemistry) On-line clip on Chemical Bonding	Test question later **CFA: Midyear Exam MCAS Essay Question – Ionic vs. Covalent Bonding**
	RST 9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.	Modern Chemistry text (Ch 6,7) Casseopeia Project (Chemistry) on-line simulation discussion of BONDING *www.**cassiopeiaproject**.com* Magnetic and Ball & Stick Molecular Model Lab	Computer Lab: View Casseopeia Project (Chemistry) On-line clip on Chemical Bonding **CFA: Molecular Model Lab**	**CFA: Midyear Exam MCAS Essay Question – Ionic vs. Covalent Bonding**
Writing Standards	**WHST2.** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.		Computer Lab: View Casseopeia Project – (Chemistry) On-line clip on Chemical	WAC writing sample To contrast the mechanism of ionic to covalent bonding as described in

			Bonding *www.**cassiopeiaproject**.com*	Casseopeia clip. **CFA: Molecular Model Lab**

Unit 5: Chemical Reactions and Stoichiometry
Essential Questions
What does a reaction equation represent?
Why must a chemical reaction equation balanced?
How is a chemical equation balanced using coefficients?
How are chemical reactions classified?
What is the mole in terms of mass (molar mass) of a pure substance and its particle count (Avogadro's Number)?
How is percent composition of a compound calculated?
How is the empirical formula of a compound calculated given percent composition?
How do the coefficients in a balanced equation relate to the molar ratio and how is the molar ratio used in stoichiometry problems?
How is the theoretical yield of a chemical reaction calculated and how is the percentage yield of a chemical reaction calculated?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
5.1 Balance chemical equations by applying the laws of conservation of mass ant composition	Write a word equation and a chemical equation for a given chemical reaction Balance a chemical equation using coefficients. Know the 7 diatomic molecules. Be familiar with symbols used in an equation ex. (aq) = aqueous solution. Students will write chemical equations from the given word equation (remembering all diatomic elements, properly writing chemical formulas and balancing equation using coefficients)	1. Modern Chemistry text (Ch 8) 2.Text Review Sheet	Practice worksheets. Dipsticking	Quiz: Chemical Reactions
5.2 Classify chemical reactions as synthesis(combination),	Classify reactions according to type given the complete balanced equation.	1. Modern Chemistry text 2.Text Review Sheets	Drill Group work	Quiz: Chemical Reactions CFA: Evidence of

decomposition, single replacement, and double replacement and combustion			Whiteboards CFA: Evidence of Chemical Reactions Lab	Chemical Reactions Lab
5.3 Use the mole concept to determine number of particles and molar mass	Use dimensional analysis to solve mole conversions relating to mass or particle number	1. Modern Chemistry text (Ch 9) 2.Text Review Sheets	Drill Group Worksheets Graphic Organizer" "Meet the Mole"/ "Mole Map"	Quiz: Mole conversions
5.4 Determine percent composition, empirical formulas, and molecular formulas.	Determine percent composition from lab analysis data and from chemical formula of a compound	1. Modern Chemistry text 2.Text Review Sheets	Drill Group Worksheets **CFA: Percent Composition Lab**	Quiz: Percent composition and empirical/molecular formulas **CFA: Percent Composition Lab**
5.5 Calculate the mass-to-mass stoichiometry for a chemical reaction.	Define the coefficients in a balanced equation State the importance of Mole Ratio and write a mole ratio of any two substances in a balanced equation. Calculate the mass of reactant or product given the mass of another reactant or product using three step "mole map"	1. Modern Chemistry text 2.Text Review Sheets	Drill Power-point problems Practice worksheets Group work **CFA: Stoichiometry Lab**	Stoichiometry Quiz Test questions later **CFA: Stoichiometry Lab**
5.6 Calculate Percent Yield in a chemical reaction.	Calculate the theoretical yield of a product given the mass of the limiting reactant. Calculate the percent yield given the actual yield and calculating the theoretical yield. Determine the limiting reactant .	1. Modern Chemistry text 2.Text Review Sheets	Drill Worksheets Powerpoint problems Open notebook quiz **CFA: Stoichiometry Lab**	Quiz- Stoichiometry Test Questions Later **CFA: Stoichiometry Lab**
Science Inquiry Skills	SIS2: Design and conduct scientific investigation. Write procedures that are clear and replicable.	1. Modern Chemistry text 2.Text Review Sheets 3. Lab handout	**CFA: Percent Composition Lab**	**CFA: Percent Composition Lab**

		and rubric		
Science Inquiry Skills	SIS4: Construct a reasonable argument and respond appropriately to critical comments and questions. (sources of errors)	1. Modern Chemistry text 2.Text Review Sheets 3. Handout and rubric for Percent Composition Lab 4.Handout and rubric for Stoichiometry Lab	**CFA's: Percent Composition Lab & Stoichiometry Lab**	**CFA's: Percent Composition Lab & Stoichiometry Lab**
Science Inquiry Skills	SIS3: Use mathematical operations to analyze and interpret data results.	1.Modern Chemistry text 2.Text Review Sheets 3. Handout and Rubric for Percent Composition Lab 4.Handout and rubric for stoichiometry lab.	**CFA's: Percent Composition Lab & Stoichiometry Lab**	**CFA's: Percent Composition Lab & Stoichiometry Lab**
Mathematical Skills	Measure with accuracy and precision. Perform statistical procedures to analyze data. (percent error and percent yield) Construct and use tables and graphs to interpret data sets.	1. Modern Chemistry text 2.Text review sheets for problem solving 3. Handout and Rubric for Percent Composition Lab 4.Handout and rubric for stoichiometry lab.	**CFA's: Percent Composition Lab and Stoichiometry Lab**	**CFA's: Percent Composition Lab and Stoichiometry Lab**
Reading Standards	RST3: 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.	Handout for Stoichiometry Lab	**CFA: Stoichiometry Lab**	**CFA: Stoichiometry Lab**
Writing Standard	**WHST 4.** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Handout and rubric for Percent Compostion Lab.	Write a clear coherent replicable procedure to experimentally determine the percent composition of a hydrate.	**CFA: Percent Composition Lab**

Unit: States of Matter, Kinetic Molecular Theory, and Thermochemistry
Essential Questions
How do gas molecules move and how are they arranged?
How is the behavior of a gas modeled by the kinetic molecular theory?
How are Boyle's, Charles', Gay-Lussac's Laws used in calculations?
How do properties of gases, liquids and solids compare in terms of kinetic moelcular theory?
What are the driving forces of a chemical reaction?
What role does heat play in physical and chemical changes?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
6.1- Using the kinetic molecular theory, explain the behavior of gases and the relationship between Pressure vs. Volume (Boyles), Volume vs. Temperature (Charles'), Pressure vs. Temperature (Gay-Lussac's), number of particles in a gas sample (Avogadro's). Use the Combined Gas Law to determine changes in pressure, volume and temperature.	State the kinetic theory of matter and describe how it pertains to the relationship between gas volume, temperature and pressure. Describe gas pressure and how it is measured. State standard conditions of temperature and pressure. Use Boyle's Law to calculate volume-pressure changes at constant temperature. Use Charles' Law to calculate temp-volume changes at constant pressure. Use Gay-Lussac's Law to calculate pressure-temp changes at constant volume Use Combined Law to calculate V-T-P changes or to derive Boyle's, Charles', or Gay-Lussac's	Modern Chemistry text Gas Law Problems Powerpoint (T-Drive) Problem Sets Gas Law Worksheet	Group problem solving Dipsticking Worksheet- Gas Laws Demonstrations with vacuum pump, balloons, Peeps, pressure syringe **CFA: Molar Volume Lab**	Homework Problem Set Quiz- Gas Laws Later test questions **CFA: Molar Volume Lab**
6.2: Perform calculations using ideal gas law. Understand the molar volume at 273 K and 1 atm (STP)	Given values for all except one of the variables in the Ideal Gas Law Equation, calculate the value of the remaining variable. (PV = nRT) Use appropriate "R" constant based on pressure unit used eg. atm, torr, or kPa Identify pressure and volume conditions at which a gas most closely resembles an "ideal gas"	Modern Chemistry text Problem Sets Gas Law Worksheet	Group problem solving Worksheet- Gas Laws Demonstrations with vacuum pump, balloons, Peeps, pressure syringe	Homework Problem Set Quiz- Gas Laws Later test questions

	Recognize that the rate of gas diffusion is inversely proportional to √ molar mass.			
6.3: Using the kinetic molecular theory, describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.	Sketch models of solid, liquid and gas showing position of the particles Sketch a heat vs. temperature phase change diagram of water showing plateau area for phase change	Modern Chemistry text Heat vs. temperature phase change curve of water Thermometers/or Vernier temperature probes	Demonstration/or activity involving phase change of water to plot a heat vs. temperature graph. Worksheet- Chapter 12	Homework, Chapter 12 Quiz- Phase Changes of Solids, Liquids and Gases
6.4: Describe the law of conservation of energy. Explain the difference between an endothermic process and an exothermic process.	Recognize that melting and boiling is an endothermic phase change. . Recognize that freezing and condensing are exothermic phase changes. Recognize that change in enthalpy value is negative for an exothermic reaction and is positive for an endothermic reaction.	Modern Chemistry text Heat vs. temperature phase change curve of water. Thermometers/or Vernier temperature probes	Worksheet- Chapter 12 Optional Lab- Calculating the Heat of Fusion of Ice	Homework Quiz- States of Matter, Phase Change Optional Lab Report- Heat of Fusion of Ice
6.5- Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness.	Explain the relationship between enthalpy change and the tendency of a reaction to occur. Explain the relationship between entropy change and the tendency of a reaction to occur.	Modern Chemistry text	Worksheet Chapter 17	Homework
Science Inquiry	SIS3. Analyze and interpret results of scientific investigations. Present relationships between and among variables in appropriate forms. Represent data and relationships between and among variables in charts and graphs. Use mathematical operations to analyze and interpret data results. Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions.	Molar Volume of Hydrogen Gas handout and rubric	**CFA: Molar Volume Lab**	**CFA: Molar Volume Lab**

Mathematical Skills	Solve simple algebraic expressions Measure with accuracy and precision Determine percent error from experimental and accepted values. Use the Celsius and Kelvin scales.	Molar Volume of Hydrogen Gas handout and rubric	**CFA: Molar Volume Lab**	**CFA: Molar Volume Lab**
Reading Standards	RST3: 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.	Molar Volume of Hydrogen Gas handout and rubric	**CFA: Molar Volume Lab**	**CFA: Molar Volume Lab**
	RST8: Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.	Modern Chemistry Text- P. 307 Research Notes "Carbon Monoxide- Stopping the Silent Killer" USA Today- *Blizzard Deaths* Carbon monoxide article – and passage from on-line forum	Read article *on Blizzard Deaths* carbon monoxide and answer questions	Submit article questions on *Blizzard Deaths*
Writing Standards	**WHST 2.** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Modern Chemistry Text Chapter 11 Pre-Lab Discussion and notes for CFA Molar Volume Lab	**CFA: Molar Volume Lab**	**CFA: Molar Volume Lab**

Unit: Solutions, Rates of Reaction, and Equilibrium
Essential Questions
What are the characteristics of a solution?
How do the structural formulas and strength of intermolecular forces of solutes and solvents play a pivotal role in whether they will dissolve in each other?
How is the concentration of a solution calculated in terms of percentage by mass? molarity? molality?
What factors influence the rate at which a solute dissolved in a solvent?
How is the dilution equation (McVc = MdVd) used to determine how to make a lilquid soluton?
What are colligative properties? How does molality of a solution relate to freezing point depression or boiling point elevation?
How is the molarity concept used in solution stoichiometry?
What is the rule of solubility ("like dissolves like") and how is it used to predict whether a solution will form?
How is Le-Chatelier's Principle employed to predict and equilibrium shift?
What factors influence the rate of a reaction and how are these explained in terms of kinetic theory and/or energy?
How does a catalyst or enzyme work?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
7.1- Describe the process by which solutes dissolve in solvents	Distinguish between heterogeneous and homogeneous mixtures. Diagram the dissolving process of ionic or polar solutes in water. List three different solute-solvent combinations. Compare the properties of suspensions, colloids and solutions. Interpret solubility tables to identify if a solution is saturated, unsaturated or supersaturated. Contrast the qualitative terms dilute to concentrated. Write net-ionic equation for dissolving process. Distinguish between strong electrolytes, weak electrolytes, and nonelectrolytes. Recognize that a saturated solution is a system at equilibrium.	Modern Chemistry, Chapter 13 Light bulb conductivity apparatus with various solution Various solutes: ionic salts, polar sugar, nonpolar oils. Various solvents: polar water, alcohol Chart, Solubility Curves or Figure 13.15 on p. 408	Brainstorm different solute/solvent combinations Demonstrate various solute/solvent combinations to predict solubility Common worksheet: Solubility Curve Interpretation Diagram the dissolution process of salt in water. Demonstration: Use light bulb conductivity apparatus to illustrate strong, weak, and nonelectrolytes	Homework Quiz- Solutions Later test questions

7.2- Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry.	Calculate the concentration (molarity) of a solution given the mass of the solute and volume of solvent. Given the molarity of the solution, determine the amount of solute in a given amount of solution. Calculate the percent by mass of solute in solution. Use dilution equation McVc = MdVd to calculate volume of concentrated solution needed to make a diluted solution by adding water. Problem Solving: 1.Molarity = moles solute/L of solution Ex) 0.40 g of NaOH is dissolved in 500mLs of solution. Calculate the molarity. Ex) How many grams of NaCl do you need to make 250 mLs of a 0.50 M solution? Ex) How many grams of sugar and how many mLs of water needed to make 50mls of a 20.0% sugar solution? Ex)How many mLs of 12 M HCl would it take to make 100mLs of 1 M HCl?	Modern Chemistry, Chapter 13 Salt, sugar, food coloring, graduated pipettes, volumetric flasks	Learning buddies Group problem solving Peer Teaching White Boards Demonstration: Using the dilution equation to make an aqueous food coloring solution Practical lab activity: Making solutions of accurate concentrations	Homework, Quiz- Solutions
7.3 Identify and explain the factors that affect the rate of dissolving(e.g. temperature, concentrations, surface area, pressure, mixing	Discuss the factors that affect how fast a solute dissolves in terms of particles of solute and particles of solvent colliding.	1. Modern Chemistry text 2. Text Review Sheets 3. Textbook resource powerpoints	Demonstration Dipsticking	Test questions later.
7.4- Compare and contrast qualitatively the properties of solutions and pure solvents	List three colligative properties, and explain why they are classified as colligative properties. Calculate freezing-point depression, boiling-point elevation, and solution molality of nonelectrolyte solutions. Calculate the expected changes in freezing point and boiling point of an electrolyte solution. Write equations for dissolution of soluble ionic compounds in water. Predict whether a precipitate will form when solutions of soluble ionic	Modern Chemistry, Chapter 14 Powerpoint Presentation: Variety of Freezing Point Depression and Boiling Point Elevation Problems	Activity/Demonstration Boiling point elevation and freezing point depression of a salt water solution. Fun Lab: Making use of colligative properties to make ICE CREAM!	Homework, Chapter 14 Quiz- Solutions

	compounds are combined. Distinguish between strong electrolytes, weak electrolytes and non electrolytes. Recognize three colligative properties of solutions (vapor pressure lowering, boiling pt. elevation, freezing pt. depression) Define Le-Chatelier's Principle at equilibrium conditions. Recognize that a saturated solution is a system at equilibrium.	Fun Lab: Making use of Colligative Properties to make ICE CREAM!		
7.5- Identify factors that affect the rate of reaction (temperature, concentration, pressure, particle size, surface area and catalyst)	Establish reaction rate as a function of frequency and orientation of molecular collisions. Explain the effect of temperature on reaction rate. Explain the change of concentration on reaction rate. Explain the effect of surface area on reaction rate. Explain the effect of pressure on reaction rate. Explain the function of a catalyst and its ability to lower activation energy	Modern Chemistry, Ch. 17 Graph: Energy Profile of Catalyzed vs. Uncatalyzed Reaction, Fig. 17-15 p. 541	Demonstration: Enzymatic (catalyst) action of manganese dioxide in the decomposition of hydrogen peroxide. Guided energy diagram of a catalyzed vs. uncatatlyzed reaction. Demonstration: Reversible Reaction Effect of changing temperature on Equilibrium shift	Homework, Chapter 17 Quiz- Kinetics and Reaction Rates
7.6 – Predict the shift in equilibrium when a system is subjected to a stress (Le-Chatelier's Principle) and identify the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature)	Predict direction of equilibrium shift, given a change to the system at equilibrium.	Text Modern Chemistry Section Review Worksheets	Worksheets Demonstration: Reversible Reaction	Homework Equilibrium Worksheet
Science Inquiry Skills	SIS2: Make and record measurements at appropriate levels of precision. Properly use instruments, equipment, and materials(e.g. scales, and volumetric flasks) Follow safety guidelines.	Flasks, Graduated cylinders, electronic balance, food coloring, sugar, salt, water	Make solutions of various molar concentrations using common lab equipment and materials	Practical Chemistry worksheet- making solutions and dilutions

Mathematical Skills	Solve simple algebraic expressions. Use ratio and proportion to solve problems. Use common metric prefixes.	Text: Modern Chemistry Chapter 13 Practical Chemistry handout- Making Solutions and Dilutions handout	Problem Solving Set- Solution Concentration Calculations (Small group) Brainstorming "How would you make 100 mLs of a 0.10 M solution given a 1.0 M solution?" Demonstrate a dilution for the class	Practical Chemistry handout- making solutions and dilutions independently
Reading Standards	RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.	Text: Modern Chemistry Chapter 13	Solubility Data- 1) Solution Terminology 2) Solubility Curves 3) Solubility Rules	
Writing Standards	**WHST 4.** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Text: Modern Chemistry Chapter 13	WAC II- Describe factors affecting the solubility of a gas or a solid in a liquid solvent. WAC II- Describe 3 stresses that can shift an equilibrium system according to Le-Chatelier's Priinciple	Submit WAC for assessment

Unit: 8 Acids and Bases and Oxidation-Reduction Reactions
Essential Questions
What are the areas of science where acids and bases play an important role?
What is an oxidation reduction reaction in terms of electron transfer?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
8.1- Define Arrhenius Theory of acids and bases in terms of the presence of hydronium ions and hydroxide ions in water. Define Bronsted Acid and Base in terms of proton donor or acceptor.	Recognize an Arrhenius Acid by its ability to form hydronium ions in aqueous solution. Recognize an Arrhenius Base by its ability to form hydroxide ions in aqueous solution. Identify the proton donor (Bronsted Acid) and proton acceptor (Bronsted Base) along with the conjugate acid and conjugate base given a proton transfer reaction. General properties of acids and bases. Contrast strong to weak acids in terms of proton donating ability and percent ionization in water.	1. Modern Chemistry text (Ch 15) 2.Text Review Sheets 3. Strength of acid and conjugate base chart	Dipsticking White Boards Worksheets Textbook Review Sheets	Quiz: Acids and Bases Test questions later.
8.2- Relate Hydrogen ion concentration to pH Scale and compare strengths of various common acids and bases (eg. vinegar, citrus juice, baking soda, soap etc)	Understand that pH (level of acidity) is related to the molar concentration of the hydronium ion in solution. Solve pH problems given concentration of H+ or OH- ion. Solve for H or OH concentration, given pH. Estimate the pH of some common household solutions. Determine the concentration of unknown acid or base solution by titration,. Know common acid/base indicators. Titrate accurately and precisely to determine an exact molarity of an unknown acid or base. Use titration equation: MaVa = MbVa	1. Modern Chemistry text (Ch 16) 2.Text Review Sheets Text book powerpoint	pH demonstration with probe pH Indicator Lab CFA: Acid/Base Titration Lab	Quiz: Acids and Bases Test questions later
8.3-Explain how a buffer works	Define a buffer in terms of an acid and its conjugate base	1. Modern Chemistry text 2.Text Review Sheets		Acid Base Test
8.4- Describe oxidation and reduction reactions and give some everyday examples, such as fuel burning and corrosion. Assign oxidation numbers in a reaction.	Identify oxidation reactions as a category of reaction Assign oxidation numbers and recognize changes in oxidation numbers of the elements undergoing redox reaction	1. Modern Chemistry text 2.Text Review Sheets	Dipsticking White board checking Practice worksheets for assigning oxidation number	Quiz: Redox reactions

Science Inquiry	SIS2: Employ appropriate methods for accurately and consistently making and recording measurements at appropriate levels of precision. Properly use instruments, equipment and materials including set-up, and technique. SIS4: Communicate and apply the results of scientific investigations. Develop descriptions of and explanations for scientific concepts that were a focus of one more investigations.	CFA: Acid/Base Titration Lab	CFA: Acid/Base Titration Lab	CFA: Lab Report: Acid/Base Titration Lab
Mathematical Skills	Solve simple algebraic expressions. Measure with accuracy and precision.	Vernier pH Probe to measure an accurate value of pH Accurate volume measurement using burets	Group Problem Solving- algebraic manipulation of Titration Equation	CFA: Lab Report: Acid/Base Titration
Reading Standards	RST3: 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: RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*: RST 5: Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas RST8: Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information	CFA: Acid/Base Titration Lab Procedure	CFA: Acid/Base Titration Lab	CFA: Acid/Base Titration Lab
Writing Standards	**WHST2.** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating	Acid/Base Titration Lab	WAC II- Describe how titration is used for in the Chemistry lab. Use appropriate terminology.	CFA: Lab Report: Acid/Base Titration Lab Submit WAC

	implications or the significance of the topic).			II writing sample