Chemistry 430

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)	Cracolice & Peters, Ch. 1,2 Matter Overview Worksheet (Classes, States, Properties and Changes)	Dipsticking Whiteboards Lab: Introduction to the Chemistry Lab Measurement Activity	Selected Chapter 2 Questions, Exercises and Problems (QEP's) **CFA:Matter Overview Worksheet**
1.2 Explain the difference between pure substances and mixtures	1. Distinguish among classes of matter: element, compound, mixture (demonstrate common everyday substances)	Cracolice & Peters, Ch. 1,2 Matter Overview Worksheet (Classes, States, Properties and Changes)	1.Lab Activity: Handling Chemicals 2..Dipsticking 3.Whiteboards	Selected Chapter 2 Questions, Exercises and Problems (QEP's) Matter Overview Worksheet
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	Cracolice & Peters, Ch. 1,2 Matter Overview Worksheet (Classes, States, Properties and Changes)	1.Compare contrast discussion 2. Dipsticking	Selected Chapter 2 Questions, Exercises and Problems (QEP's) **Matter Overview Worksheet**
Science Inquiry Skills	SIS1: Make observations of properties of matter	Physical vs. Chemical Properties and Change Text Ch.2		
Science Inquiry Skills	SIS2: Employ appropriate methods for accurately and consistently	Physical vs. Chemical	Lab	Quiz and Test

	making observations, making and recording measurements at appropriate levels of precision, collecting data or evidence in an organized way.	Properties and Change Text Ch.2	Activity/Demonstration	Questions
Mathematical Skills	Determine the correct number of significant figures. Use scientific notation, where appropriate Use appropriate metric/standard	Chapter 3 Text	Measurement Lab Activity	Test Questions Lab Practicum question
Reading Standards	RST 3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	Lab handout	Density Activity	
Reading Standard	RST 5. Analyze how the text structures information or ideas and categories or hierarchies, demonstrating understanding of the information or ideas.	Text Rules for Significant Figures3.5		
Writing Standards	WRST1. Write arguments focused on *discipline-specific content.*	Lab Acticity/ Demonstration Matter/Properties	Lab Activity	Test questions
	WRST2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes	Rutherford's Gold Foil Experiment Text		WAC Test question explaining The Gold Foil Experiment

Introduction to Gases
Essential Questions
How does the Kinetic Theory of Matter model the states of matter?
What role does release or absorption energy play in phase change and in chemical reactions?
How is pressure and volume of a gas related?
How is volume and temperature of a gas related?
How is pressure and temperature of gases?
How is the Combined Gas Law used to determine changes in pressure, volume and temperature?

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	• Using Kinetic Molecular Theory explain Charles' Law, Boyle's Law, and Gay Lussac's Law. • Distinguish among pressure units: atmosphere, kilopascal, pound per square inch, torr and mm of Mercury • Know Standard Temperature Conditions = 0 C/273 K • Perform word problems: Solve algebraically for any variable given Combined Law: $P_1V_1T_2 = P_2V_2T_1$ • Perform word problems with the derived equations of Boyle's Law $P_1V_1 = P_2V_2$; Charles' Law: $V_1/T_2 = V_2/T_2$; and Gay-Lussac's Law $P_1/T_1 = P_2/T_2$	Cracolice & Peters, Ch. 4 Teacher designed worksheet Powerpoint Notes Vacuum Pump, Balloons, potato gun	Group problem solving Demonstrations: Vernier Pressure syringe, Expanding/Collapsing balloon.	Selected end of Chapter 4 QEP's Quiz – Gas Law Problems Ch. 4 Test
6.3- Using the Kinetic Molecular Theory, describe and contrast specific properties of gases, liquid and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.	• Describe the three states of matter in terms of the relative kinetic energy and the position of the molecules in each phase. • Identify and explain the differences among gases, liquids and solids in terms of a)visible properties b) distance between particles c) and particle movement. • Describe the phase changes of melting, freezing, boiling, condensing and subliming in terms of the changes in kinetic energy of the particles.	Cracolice & Peters, Ch. 4 Topic discussed in more detail in Chapter 15. Figure 2.5 (States of Matter) on p. 20	Student drawings and diagrams. Demonstrate phase change of a substance: Eg. Sublimation of dry ice	Selected end of Chapter 2 QEP's. Ch.1, 2 Test
6.4- Describe the Law of Conservation of Energy. Explain the difference between an endothermic process and exothermic process.	• Define the Law of Conservation of Energy. • List at least four forms of energy • Giv two examples from daily life of how energy changes from one form to another yet is always concserved. • Constrast endothermic to exothermic change. • Give specific examples of endothermic phase	Cracolice & Peters, Ch. 2 Topic discussed in more detail in Chapter 15. Figure 2.22 (Energy Changes) on p. 39.	Student drawings and diagrams. Demonstrat end thermic change and an exothermic change.	Selected end of Chapter 2 QEP's. Ch.1, 2 Test

	change and exothermic phase change.			
Science Inquiry Skills	SIS1. Make observations, raise questions, and formulate hypotheses**.**	Demonstration	Demonstration using Vacuum chamber/ Vernier equpiment	Test Questions
Mathematical Skills	✓ Construct and use tables and graphs to interpret data sets. ✓ Solve simple algebraic ex Convert within a unit (e.g., centimeters to meters). ✓ pressions. ✓ Use the Celsius and Kelvin scales.	Cracolice & Peters, Ch.4 Gases	Practice worksheets	Gas Law test questions
Writing Standards	Writing Standards **7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **8.** 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.		Practice worksheets	Test Question

Unit: Atomic Structure
Essential Questions
What are the main features of Dalton's Atomic Theory?
Which features of Dalton's atomic theory are no longer considered valid?
How is the Law of Conservation of Mass and Law of Definite Proportion explained by Dalton's Atomic Theory?
What are the three major subatomic particles and their respective charge, approximate mass and location in the atom?
What is the significance of Rutherford's alpha ray scattering experiment and its relationship to the nuclear model of the atom?
How are isotopes different from one another?
How do you calculate the atomic mass of an element given the relative abundancies and atomic mass of each isotope?
How do you write electron configuations for the first twenty elements of the periodic table?
How is the nuclear model used to explain radioactivity, nuclear processes, and nuclear properties?

How do nuclear reactions form elements and produce energy?

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.	• Recognize that cathode rays consist of electrons and are attracted to + electrical field. • Identify the main features of Dalton's Atomic Theory. • Identify two feature of Dalton's Atomic Theory that are no longer valid.. • Describe and interpret the Rutherford experiment and the nuclear model of the atom.	Cracolice & Peters, Ch. 5 Periodic Table Cathode Ray Tube with electrical source and strong magnet to demonstrate	Self-Help Guide Atom Packet Research Activity: Atomic Pioneers in Library Computer Lab	Selected Chapter 5 QEP's Quiz- Atomic Theory Ch. 5 Study Guide Ch. 5 Test
2.2: Describe Rutherford's gold foil experiment that led to the discovery of the nuclear atom.	• Interpret alpha ray/gold foil experiment. Predict Rutherford's initial hypothesis. • Draw conclusions based on the results of Rutherford's experiment. Nucleus is +, small and dense. • Calculate the # electrons, # neutrons, # protons given the mass number and atomic notation for a given isotope. • Calculate the atomic mass of an element given the percentage abundancy and atomic mass of each isotope.	Cracolice & Peters, Ch. 5 Overhead of the Rutherford Experiment DVD: Bohr's Model of Atom	Self-Help Guide Atom Packet Research Activity: Atomic Pioneers in Library Computer Lab	Selected end of Chapter 5 QEP's Quiz- Atomic Theory Ch. 5 Study Guide Ch. 5 Test
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 • Illustrate how the Law of Conservation of Mass relates to a simple balanced equation.	Cracolice & Peters Chapter 2 (pp. 37, 38)	Demonstrate chemical reactions and analyze the corresponding balanced equations.	Selected Chapter 5 QEP's Quiz- Atomic Theory Ch. 5 Study Guide Ch. 5 Test

.**2.4:** Be able to write electron configurations for the first 20 elements on the periodic table.	• Draw orbital notations and electron configurations for representative elements such as: Ne, Na, Ca, Rb, S, Br, Xe. Diagonal Rule can be used. • Summarize Quantum #: Principal, Angular Momentum, Magnetic and Spin. • Explain how electron configurations related to chemical reactivity. • Utilize abbreviated supplied on long form Periodic Table	Cracolice & Peters, Ch. 11 Powerpoint Presentation: Quantum Numbers Diagonal Rule handout or Figure 11.13- 11.15 on pp. 316, 317. Transparencies of s,p, and d sublevel cloud shapes.	Powerpoint presentation to introduce Aufbau Principle and Hund's Rule. Dipsticking Group Problem Solving Learning Buddies	Selected Chapter 11 QEP's GroupWorksheet: Orbital Notations and Electron Configurations Quiz- Quantum Numbers and Electron Configurations Ch. 11 Test
2.5: Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power).	• Define radioactivity . Name, identify and describe the three radioactive emissions (alpha, beta, and gamma rays). • Define and identify transuranium elements. • Explain how radiation may harm human systems.	Cracolice & Peters Chapter 20 Powerpoint presentation on nuclear chemistry (T Drive)	Nuclear Research Activity: Student e.g. powerpoint projects on nuclear topics (library computer lab). Reading Assignment: Japan Reactor Disaster e.g. -accident	Selected Chapter 20 QEP's Quiz- Nuclear Chemistry Ch. 20 Test (optional) Student powerpoint presentations
2.6: Describe the process of radioactive decay by using nuclear equations, and explain the concept of half-life for an isotope (for example, C-14 is a powerful tool in determining the age of objects).	• Write nuclear equations for alpha decay showing the emission of a Helium nucleus. • Write nuclear equation for beta decay.	Cracolice & Peters Chapter 20 Powerpoint presentation on nuclear chemistry	Nuclear Research Activity: Student powerpoint projects on nuclear topics (library computer lab).	Selected Chapter 20 QEP's Quiz- Nuclear Chmistry Ch. 20 Test (optional) Student Powerpoint Presentations
2.7 Compare and contrast nuclear fission and nuclear fusion.	• Write nuclear equation for nuclear fission (as in a reactor). • Write nuclear equation for nuclear fusion (as in our sun, or stars).	Cracolice & Peters Chapter 20 Powerpoint	Nuclear Research Activity: Student powerpoint projects on Nuclear Topics (library	Quiz- Nuclear Chemistry Ch. 20 Test (optional) Student Powerpoint

	• Solve half-life problems	presentation on nuclear chemistry		Presentations
Mathematical Skills	• Solve simple algebraic expressions. • Use appropriate metric/standard international (SI) units of measurement for mass (kg); length (m); time (s); force (N); speed (m/s); acceleration (m/s^2); frequency (Hz); work and energy (J); power (W); momentum (kg•m/s); electric current (A); electric potential difference/voltage (V); and electric resistance (Ω).	Cracolice & Peters Chapter 20	Half Life Practice Dipsticking	Test Questions
Reading Standards	• . 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		Atomic Theory History Assignment Nuclear Research Activity: Student	 Nuclear Research Activity: Student
Writing Standards	• . 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	WAC: Compare and contrast nuclear fission to fusion. WAC: Discuss a fission chain reaction and how this is controlled in a nuclear reactor	Nuclear Research Activity: Student	Nuclear Research Activity: Student

Unit: Periodic Table
Essential Questions
What is the basic arrangement of the periodic table?
How do families define elements with similar properties?
What repeating (periodic) patterns can be observed on the periodic table?
How do these repeating properties relate to an atom's outermost electrons?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
3.1 Explain the relationship of an	• Identify the major representative families	Cracolice & Peters, Ch. 11	Dipsticking using periodic table	Selected Chapter 11

element's position on the periodic table to its atomic number. Identify the families (groups) and periods of the periodic table.	on periodic table: alkali metals, alkaline earth metals, carbon family, halogens and noble gases. ● Identify the transition metals (B Groups) along with characteristic properties. ● Match a set of descriptive physical and chemical properties to the correct family of elements. - - Alkali - Alkaline Earth – Halogens - Noble Gases --Transition Metals	Periodic Table t with abbreviated Nobel Gas Core Configurations. Blank Periodic Table handouts + overhead, crayons, colored pencils On-line Resources: Interactive Periodic Table ChemicalElements.com: **Online Periodic Table** **Interactive Periodic Table**	Design a periodic table that color codes families, labels metals, nonmetals, metalloids. Research Activity: Element and Family Properties in library computer lab.	QEP's Quiz- Periodic Table and Trends Ch. 11 Test
3.2: Use the periodic table to identify the three classes of elements: metals, nonmetals and metalloids	● Locate metals, nonmetals and metalloids on the periodic table. ● Recognize general physical properties of metals, nonmetals and metalloids. ● Recognize common and daily uses for metals, nonmetals, and metalloids. ● On blank periodic table, identify and label groups (families), periods, sublevel blocks (s,p,d,f) by color coding, outer electron configurations, and ionic charges. ● Abbreviate more complex electron configurations using a noble gas core notation.	Cracolice & Peters Ch. 11 Blank periodic table Periodic table on powerpoint projection or overhead Puzzles using Periodic Table		Selected Chapter 11 QEP's Quiz- Periodic Table and Trends Ch. 11 Test
3.3. Relate the position of an element on the periodic table to its electron confiuguration and how compare its	● Explain why alkali metals are the most reactive based on their valence electron configurations.	Cracolice & Peters, Chapter 11 Periodic Table with	Study Figure 11.18 on p. 325 of text to illustrate reactivity series.	Selected Chapter 11 QEP's

reactivity with other elements on the table.	• Explain why halogens are the most reactive nonmetals based on their valence electron configurations. • Explain why noble gases are inert based on their outer electron configurations.	abbrevieated noble gas configurations Library Computer Lab On-line Resources: Interactive Periodic Table ChemicalElements.com: **Online Periodic Table** **Interactive Periodic Table**	Project/Peer Teaching: Research and/or present information on an element and family using student designed powerpoints (Library Computer Lab)	Element/Family Research Project Quiz- Periodic Table and Trends Chapter 11 Test
3.4- Identify trends on the periodic table(ionization energy, electronegativity, and relative size of atoms and ions)	• Using periodic trends of atomic radius, ionization energy, electronegativity, rank a list of elements from small to large atomic radius, high to low ionization energy etc. • Discuss trends in everyday life and how trends can be observed in the arrangement of elements in the periodic table.	Periodic Table or Charts with Atomic Radius and Ionization Energy Data. Vernier Lab Quest To access atomic radius, ionization energy and electronegativity values.	Lab: Graphing Periodic Trends using Periodic Table or Vernier Lab Quest Application	Selected Chapter 11 QEP's Quiz- Periodic Table and Trends Chapter 11 Test Lab Report: Graphing Periodic Trends
Science Inquiry Skills	• SIS1. Make observations, raise questions, and formulate hypotheses.	Hunting the Elements Video	Periodic Trend Data: Graphs, tables etc.	Test Questions
Reading Standards	**1.** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.	Cracolice & Peters, Chapter 11	Periodic Trends	Test Questions
Reading Standard	**2.** Determine the central ideas or conclusions of a text; summarize complex	Research History of the Periodic Law		Test Questions

	concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.			
Writing Standards	1. Write arguments focused on *discipline-specific content*.			Test question: Explain the theoretical basis for a given trend
Writing Standard	2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.			Test question: Explain the theoretical basis for a given trend

Unit: Chemical Bonding
Essential Questions
How do atoms bond with each other by transferring or sharing valence electrons to form compounds?
How do properties of ionic compounds contrast to covalent compounds?
How do you write chemical formulas for ionic and molecular compounds given a name?
How do you name an ionic and molecular compounds given a formula?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
4.1: Explain how atoms combine to form compounds through both ionic and covalent bonding.	• Sketch electron dot structures for representative elements with correct number of valence electrons. • Using electron dot structure, show how an ionic bond is formed by electron transfer and following the Octet Rule. • Using electron dot structures, show how a covalent bond is formed by sharing of electrons and following the Octet Rule	Cracolice & Peters, Chapter 12 pp, 338-345 Periodic Table that includes abbreviated noble gas core configuration	Draw Picture/Diagrams WAC: To compare and contrast ionic to covalent bonding	Selected Chapter 12 QEP's
4.2: Draw Lewis dot structures for	• Using electron dot structure, show how an	Cracolice & Peters, Chapter	Draw Picture/Diagrams	Selected Chapter 12 QEP's

molecules and ionic compounds.	ionic bond is formed by electron transfer and following the Octet Rule. ● Using electron dot structures, show how a covalent bond is formed by sharing of electrons and following the Octet Rule.	12 pp, 338-345 Periodic Table that includes abbreviated noble gas core configuration		
4.6: Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain polyatomic ions: ammonium, hydroxide, nitrate, phosphate and sulfate	● Calculate an ionic charge on single monatomic ions using periodic table. Ex: Sodium = Na^{1+} Oxide = O^{2-} ● Become familiar with "oxy-anions" (polyatomic ions) eg. Nitrate, sulfate, carbonate, acetate, phosphate, hydroxide, chlorate. ● Recognize transition metal ions eg. Iron III vs. Iron II. ● Recognize prefixes mono, di, tri, tetra, penta, hexa, hepta, and oct. ● Learn names and formulas three common laboratory strong acids HCl, H_2SO_4, HNO_3 and the weak acid: $HC_2H_3O_2$ ● Write names and formulas for a variety of ionic salts, covalent molecules, hydrated crystals, and acids.	Cracolice & Peters, Chapter 6 Table 6.7 and 6.8 on pp. 158, 159 Reference Tables of Polyatomic Ions	Dipsticking and Repetition Learning Buddies Mini-White Boards Group Learning Formula and Naming Grid Worksheet	Selected Chapter 6 QEP's Common assessment quiz - Formula Writing and Naming Independent Quiz-Formula Writing and Naming Chapter 6 Study Guide Chapter 6 Test
Mathematical Skills	● Use ratio and proportion to solve problems. ●	Cracolice & Peters, Chapter 6 and 7	Formula writing practice worksheets	Quiz and Test Questions

Unit: The Mole Concept
Essential Questions
What is the difference between formula mass and molar mass?

How is the molar mass of a substance determined?
How is percentage composition of a compound calculated?
How is an empirical formula and molecular formula calculated?
How is a substance's mass and number of unit particles calculated given the number of moles?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
5.3: Use the mole concept to determine the number of particles and molar mass for elements and compounds.	• Define "mole" in terms of Avogadro's # and molar mass. • Calculate the formula mass/molar mass of any compound using the periodic table; use molar mass to convert from grams to moles or moles to grams. • Perform mole conversions using Avogadro's Number of atoms, molecules or formula units.	Cracolice & Peters, Chapter 7 Worksheet: Mole Problems "MOLE" SAMPLES of various substances (Eg. water, salt, copper etc.)	Graphic Organizer: Guided problem solving Dipsticking & Repetition Demonstration: Various Mole Samples of matter (Eg. Water, salt, copper etc.) Worksheets with a wide variety of mole conversion problems Group Problem Solving	Selected Chapter 7 QEP's Quiz- Mole Conversions Chapter 7 Test
5.4: Determine the percent composition, empirical formulas and molecular formulas.	• Calculate the percent composition of elements within a familiar compound. (eg. Water, Salt, Glucose using the periodic table.) • Use mass□ mol conversions to determine the empirical formula of the compound from its percent composition. • Contrast empirical formula to molecular formula. • Determine the molecular formula from empirical	Cracolice & Peters, Chapter 7 Using Periodic Table Worksheet: Percent Composition and Empirical Formula Problems	Warm-up Problems Activity- Calculate Percent Composition of an Oreo Cookie Common Formative Assessment Lab: Percentage Composition of a Hydrate Handout: Mole Conversions	Selected Chapter 7 QEP's. Quiz- Percent Composition and Empirical Formula Problems CFA Lab Report: Percentage Water in a Hydrate Chapter 7 Test

	formula if molecular mass is			
Science Inquiry Skills	• SIS1. Make observations, raise questions, and formulate hypotheses.	Lab Handout: % Water in a Hydrate		Lab Report
Science Inquiry Skills	• SIS2. Design and conduct scientific investigations	Lab Handout: % Water in a Hydrate	Class discussion Internet search Lab Handout	Lab Report % Water in a Hydrate
Science Inquiry Skills	• SIS3. Analyze and interpret results of scientific investigations.	Lab Handout: % Water in a Hydrate		Lab Report % Water in a Hydrate
Science Inquiry Skills	• SIS4. Communicate and apply the results of scientific investigations**.**			Lab Report% Water in a Hydrate
Mathematical Skills	✓ Solve simple algebraic expressions.	Lab Handout Text		Lab Report% Water in a Hydrate
Reading Standards	**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.	Internet Search for procedure ideas		Lab Report% Water in a Hydrate

Chemistry 430 (Honors)

Unit : Chemical Reactions/Evidence of Chemical Change
Essential Questions
What are five evidences that a chemical reaction has occurred?
How are coefficients used to balance chemical equations?
What are the seven diatomic elements?
Into what five general reaction types are chemical reactions classified?
How is the Activity Table (Series) used in predicting products of single replacement reactions?
How is the Solubility Table used in predicting the precipitate of a double replacement reaction?
How does a double replacement precipitation reaction differ from a double replacement neutralization reaction?
How do you calculate the oxidation numbers of the elements in common compounds?

How is Oxidation/Reduction process the driving force for certain reactions?
How are net-ionic equations employed to represent acid/base, precipitation and redox reactions.
What are the products of hydrocarbon combustion reactions?
How do you perform a mass-to-mass stoichiometry in a three step "path" for a given chemical reaction?
How is the percent yield of a chemical reaction determined?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
5.1*:* Balance chemical equations by applying the laws of conservation of mass and constant composition (definite proportions)	• Given an unbalanced equation, balance it by inspection. • Given a balanced chemical equation, describe its meaning on the particulate and molar levels. • Memorize H_2, O_2, N_2, F_2, Cl_2, Br_2, and I_2. • Continue to perfect formula writing and chemical nomenclature.	Cracolice & Peters, Ch. 8 Handout: Symbols Used in Chemical Reactions Guided Notes: Chapter 8 Worksheets: Balancing Chemical Equations, Chemical Reactions Periodic Table, Chart of Polyatomic ion	Guided note taking Dipsticking and repetition Mini-white boards	Selected Chapter 8 QEP's Quiz- Writing and Balancing Equations Chapter 8 Test
5.2: Classify chemical reactions as synthesis (combination), decomposition, single replacement, double replacement and combustion.	• Contrast Synthesis/Combination (exothermic) vs. Decomposition (endothermic). • Memorize the products of chlorate, carbonate and hydroxide decomposition. • Predict products of Double Replacement precipitation reactions using Solubility Table and identify precipitate. • Predict products of Double Replacement Neutralization Reactions of acid + base to form soluble salt and water. • Write net-ionic equations for acid/base,	Cracolice & Peters, Ch. 8 Activity Series of Metals, p. 245 Solubility Tables, p. 252 Powerpoint Presentation on 5 Types of Chemical Reactions Craclolice & Peters, Chapter 9 (for net-ionic equations)	Guided note taking on classifying and predicting reaction products. Worksheet: Equation Writing Demonstration of each reaction type: Synthesis, Decomposition, Single Replacement, Double Replacement and Combustion Reactions Common Formative Assessment	Selected Chapter 8 QEP's. Quiz- Chemical Reaction- Chemical Reactions Chapter 8 Test

	precipitation, and redox reactions. • Predict products of familiar combustion reactions like methane, propane, pentane, glucose, octane burning in oxygen.		Lab- Evidence of Chemical Reaction	
5.5- Calculate the mass-to-mass stoichiometry for a chemical reaction	• Define Stoichiometry • Recognize that the coefficients supply the molar ratios in a balanced chemical equation. • Determine the molar ratios between any two substances in a balanced equation. • Calculate the mass of reactant or product given the mass of another reactant or product in a chemical reaction.	Cracolice & Peters, Ch. 10 Powerpoint or overhead presentation showing step-wise problem solving approach Worksheet- Stoichiometry Problems	Guided Problem Solving Group Problem Solving Peer teaching	Selected Chapter 10 QEP's Quiz- Stoichiometry Problems Ch. 10 Test
5.6- Calculate the percent yield in a chemical reactions.	• Use Mass/Mass Problem format above to determine the mass of the product (Theoretical Yield) • Perform problems using the smaller quantity of product method to determine the limiting reactant. • Use the limiting reactant to determine the amount of excess reactant left unconsumed. • Calculate the theoretical yield of product based on the amount of limiting reactant. • Contrast the terms theoretical yield vs. experimental (actual) yield. • Calculate the percent yield given the experimental (actual) yield	Cracolice & Peters, Ch. 10 Worksheet- Stoichiometry Problems	Guided step-wise problem solving using powerpoint slides or overhead. Group Problem Solving Peer Teaching Lab: Stoichiometry Lab with % Yield	Selected Chapter 10 QEP's Quiz- Stoichiometry Problems Lab Report: Stoichiometry Lab Ch. 10 Test
Science Inquiry Skills	• SIS2. Design and conduct scientific investigations**.**	Lab Handout: Stoichiometry Lab	Lab: Stoichiometry Lab with % Yield	Lab: Stoichiometry Lab with % Yield

Science Inquiry Skills	SIS3. Analyze and interpret results of scientific investigations. •	Lab Handout: Stoichiometry Lab	Lab: Stoichiometry Lab with % Yield	Lab: Stoichiometry Lab with % Yield
Science Inquiry Skills	SIS4. Communicate and apply the results of scientific investigations. •	Lab Handout: Stoichiometry Lab	Lab: Stoichiometry Lab with % Yield	Lab: Stoichiometry Lab with % Yield
Mathematical Skills	✓ Solve simple algebraic expressions. ✓ Measure with accuracy and precision (e.g., length, volume, mass, temperature, time) ✓ Determine the correct number of significant figures. ✓ Determine percent error from experimental and accepted values.	Lab Handout: Stoichiometry Lab	Lab: Stoichiometry Lab with % Yield	Lab: Stoichiometry Lab with % Yield
Reading Standards	**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.	Lab: Stoichiometry Lab with % Yield		
Writing Standards	1. Write arguments focused on *discipline-specific content*.			Lab: Stoichiometry Lab with % Yield

Unit: Chemical Reactions:Oxidation and Reduction Reactions
Essential Questions
How do you calculate the oxidation numbers of the elements in common compounds?
How is Oxidation/Reduction process the driving force for certain reactions?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments

8.4: Describe oxidation and reduction and give some everyday examples such as fuel burning, corrosion and assign oxidation numbers in a reaction. Assign oxidation numbers in a particular compound.	• Supply the oxidation number for each element in a compound. ○ Example : H_2SO_4 --□ H= 1+ S= 6^+ O= 2^- • Recognize electron transfer as a driving force of many common oxidation processes such as burning and corrosion, • Predict products of single replacement reaction using Activity Tables. ○ --cationic replacement ○ --anionic replacement • Explain these in terms of oxidation and reduction. • Understand basic REDOX theory. ○ Zn + 2 HCl (aq) □ $ZnCl_2$ (aq) + H_2 g ○ Zn is oxidized (losing electrons) ○ H^+ is reduced (gaining electrons)	Cracolice & Peters, Ch. 9 Activity Table of Metals, Ch. 9, P. 245 Hoffman Apparatus for Electrolysis	Mnenomic Devices: "LEO the lion goes GER" You Tube Clips: Thermite Reaction and Explanation Mythbusters Thermite Reaction Demonstration: Electrolysis of Water	Chapter 9 selected QEP's <u>Lab Demo/Quiz</u> Write the complete balanced equations for a series of demonstrated reactions. Ch. 8,9 Test
Mathematical Skills	✓ Solve simple algebraic expressions.		Practice assigning oxidation numbers	

Unit: Chemical Bonding: Covalent Bonding and Molecular Compounds
Essential Questions
What is the meaning of electronegativity?
How are values of electronegativity applied to predict whether a covalent bond is polar or nonpolar?
How is the VSEPR Model of electron repulsion used to predict a molecule's shape (geometry)?
How are valence number of electrons, octet rule and the VSEPR model used to draw accurate Lewis Structures?
How are ball and stick models used to demonstrate five basic molecular shapes (linear, trigonal, pyramidal, tetrahydral and bent angular)?
What are the shapes of water, carbon dioxide, ammonia and methane?
Why is it possible for symmetrical molecules to be nonpolar although they contain polar bonds?
How are hydrogen bonds formed between water molecules?
How is hydrogen bonding responsible for water's unusual properties?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
4.2- Draw Lewis Dot Structures for simple molecules and ionic compounds.	• representative elements with correct number of valence electrons. • Using electron dot structure, show how an ionic bond is formed by electron transfer and following the Octet Rule. • Using electron dot structures, show how a covalent bond is formed by sharing of electrons and following the Octet Rule. • Draw simple, intermediate, and more advanced Lewis Structures making use of total number of valence electrons and employing Octet Rule. Also sketch some exceptional structures.(SF_6, BF_3, $BeCl_2$, NO_2). • Demonstrate cases of resonance by delocalized electrons in a double or triple bond. Example: Sketch resonance structures in molecules of SO_3, SO_2 or O_3. • Sketch a metallic bond using "electron-sea model" of delocalized electrons	Cracolice & Peters, Ch. 12 Handout: Drawing Lewis Structures (easy, intermediate and advanced) Model Kits Figure 12.15 and Table 12.2 on p. 254 to illustrate Metallic Bonding	Dipsticking and Repetition Demonstration of Covalent Bonding with Ball and Stick Models Student Drawings and Diagrams Video- Bonding in Metals	Selected Chapter 12 QEP's Collins Writing: Contrast Lewis Dot Structure of an ionic to covalent compound Quiz- Simple Lewis Structures Chapter 12, 13 Test
4.3- Use electronegativity to explain the difference between polar and nonpolar covalent bonds.	• Use Bond Energy Chart to add up the total bond energy for a molecule. • Using electronegativity chart, identify four elements with the highest values. • Explain periodic trends and patterns of electronegativity. • Identify molecules as nonpolar covalent, polar covalent based on difference in electronegativity values between the bonded elements.	Cracolice & Peters, Ch. 12 Worksheet: Drawing Lewis Structures (easy, intermediate, and advanced) Magnetic and Ball and Stick Models Bond Energy Table Electronegativity Table or	Dipsticking and Repetition Demonstration of Covalent Bonding with model kits. Student drawings and diagrams.	Selected Chapter 12 QEP's Quiz- Simple Lewis Structures Common Formative Assessment Lab Report: Molecular Models Chapter 12, 13 Test

		Fig. 12.9, p. 347		
4.4-Use valence-shell electron pair repulsion theory (VSEPR) to predict molecular geometry of simple molecules.	• Predict molecular shapes/geometries: linear, trigonal, tetrahedral, trigonal bipyramidal, pyramidal, and bent/angular based on VSEPR model. • Address exceptional geometries such as trigonal bipyramidal and octahedral cases. • Construct basic molecules with ball and stick models to recognize the various geometries. • Based on the molecular geometry, explain why a molecule is non-polar yet consists of polar bonds. Eg. CCl_4. • Diagram "electron promotion" into higher energy orbitals to form hybrid orbitals. • Show how methane's (CH_4) tetrahedral geometry is based on its sp^3 hybridization. • (Optional) Demonstrate how trigonal geometries are based on sp^2 hybridization and how linear geometries are based on sp hybridization.	Cracolice & Peters, Ch. 13 Electronegativity Table or Fig. 12.9 p. 347 Table 13.2 (Molecular Geometries) on p. 371 Magnetic Models to illustrate electron repulsion concept. Powerpoint Review notes on Lewis Structures.	Demonstrate electron pair repulsion with magnetic or balloon models. Guided study of Table 13.2 on p. 371 Student drawings and diagrams. Common Lab: Shapes of Molecules using Model Kits	Selected Chapter 13 QEP's Quiz- Lewis Structures Common Formative Assessment Lab Report: Molecular Models Chapter 12,13 Test
4.5- Identify how hydrogen bonding in water affects a variety of physical, chemical and biological phenomena (eg. surface tension, capillary action, density and boiling point)	• Draw 4-5 water molecules showing the interaction of electrons and atoms during Hydrogen Bonding. • List four of water's unusual properties and how polarity and Hydrogen Bonding account for these properties. • Determine the type of intermolecular force: dispersion force, dipole interaction or H-bonding based on the molecule's structure. • Interpret Table 15.1, p. 424; Table 15.2, p. 426. • Observe 3-4 properties of water compared to alcohol or acetone based on the strength of	Cracolice & Peters, Ch.15 Figure 15.11 p. 428 to illustrate Hydrogen Bonding. Figures 15.13- 15.17 on pp. 450-453 to illustrate concepts of intermolecular forces. Vernier hand-held with temperature probe	Guided interpretation of figures and tables supplied in Chapter 15. Demonstration: Evaporation rate of acetone vs. alcohol vs. water. Use temperature probeware to observe phase change	Selected Chapter 15 QEP's. Quiz- Intermolecular Forces Chapter 15 Test

	Hydrogen Bonding. • Interpret Figures 15.13 – 15.18, pp.430-434 • Relate strength of intermolecular force to a liquid's vapor pressure. • Rank substances in order of melting point or boiling point based on the strength of the intermolecular forces. • Explain metallic bonding in terms of "electron sea" model. • How does bonding in metals determine metallic properties?			
Science Inquiry Skills	• SIS2. Design and conduct scientific investigations.	Bonding in Solids Lab		Bonding in Solids Lab Report
Science Inquiry Skills	• SIS3. Analyze and interpret results of scientific investigations.	Bonding in Solids Lab		Bonding in Solids Lab Report
Communicate and apply the results of scientific investigations.	Communicate and apply the results of scientific investigations.	Communicate and apply the results of scientific investigations.	Communicate and apply the results of scientific investigations.	Communicate and apply the results of scientific investigations.
Reading Standards	**5.** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.	Text and Lab Handout	Dipsticking	
Writing Standards	Write arguments focused on *discipline-specific content*	Bonding in Solids Lab Text		Bonding in Solids Lab Report

Unit: Gas Laws :States of Matter, Kinetic Molecular Theory, and Thermochemisty
Essential Questions
How does Avogadro's Law relate volume to the amount of gas?
How does the ideal gas law relate pressure, volume, mass to temperature?

When is the ideal gas law used in calculations at non-standard conditions?
How is molar volume used in gas stoichiometry at standard temperature and pressure?
How is molar volume used to calculate the density of a gas at standard temperature and pressure?
How does the boiling process relate to vapor pressure and strength of intermolecular forces in a liquid?
What is the relationship between vapor pressure and temperature of a liquid-vapor system in equilibrium?
How are energy changes calculated during phase transitions?
How are energy changes calculated using specific heat values with changes of temperature (non-phase change)?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
6.2- Perform calculations using the ideas gas law. Understand the molar volume at 273 K and 1 atmosphere (STP).	• Solve problems using the ideal gas law. PV = nRT • Solve problems using ideal gas law in the form of PV = mRT / MM (molar mass) • Perform gas stoichiometry at standard temperature and pressure using molar volume. • Solve gas density problems using molar volume. • Perform gas stoichiometry an non-standard conditions using the ideal gas law to determine "n" number of moles. • Given the total pressure of a gaseous mixture and the partial pressures of all the components, except one, find the partial pressure of the remaining component. • Explain Graham's Law of Effusion.	Cracolice & Peters, Chapter 14 Provide "R" constant values Chart: Temperature vs. Partial Pressure values Eudiometers to collect gas samples	Guided problem solving Group problem solving and peer teaching. Common Lab- Experimental determination of the molar volume of hydrogen gas Demonstrate Graham's Law of Effusion in a glass tube.	Selected Chapter 14 QEP's Quiz- Ideal Gas Law Chapter 14 Test Common formative assessment lab report: Molar Volume of Hydrogen @ STP.
6.3- Using the kinetic molecular theory, describe and contrast the properties of gases, liquids and solids. Explain at the the molecular level, the behavior of matter as it undergoes phase transitions.	• Interpret effect of intermolecular forces on a liquid's properties. • Describe phase change in terms of dynamic equilibrium. • Describe the boiling process in terms of vapor pressure, and surrounding pressure. • Define Heat of Fusion and Heat of Vaporization.	Cracolice & Peters, Ch. 15 Phase Change Diagram of Water, Fig. 15.32, p. 448 Chart/Graph: Vapor	Student drawings and diagrams Demonstration: Phase change diagram of water Observe and graph the "plateau" at boiling point of a time vs. temperature graph using Vernier probeware.	Selected Chapter 15 QEP's Quiz- Energy and Changes of State Group Problems

	• Relate strength of intermolecular force to a liquid's vapor pressure and boiling point. • Interpret vapor pressure curves of three liquids at different temperatures. • Interpret phase change diagram of distilled water (energy vs. temperature). Locate plateau area and explain significance. Calculate Heat Transfer for phase change using Heat of Fusion and Heat of Vaporization data. • Interpret a phase change diagram (pressure vs. temperature) and identifying the triple point. • Classify types of crystalline solids: ionic, molecular, covalent network, and metallic	pressure curves, Fig. 15.16 p. 433 Chart/Graph: Kinetic energy distribution curve, Fig. 15.17, p. 433 Chart/Table: Heats of Fusion and Heats of Vaporization., Table 15.4, P. 443 Vernier hand-held with temperature probeware		Chapter 15 Test
6.4- Describe the law of conservation of energy. Explain the difference between endothermic and exothermic processes	• Write thermochemical equations for endothermic and exothermic reactions indicating direction of heat flow. • Calculate Heat Transfer (Q) using expression: ○ Q = m X C X □T • Perform a calorimetry experiment to determine Heat of Reaction for a chemical change. • Employ First Law of Thermodynamics in using Q rxn = - Q water in calorimeter.	Cracolice & Peters, Chapter 10 pp. 290-293(for thermochemical equations) Cracolice & Peters, Chapter 15 Coffee cup calorimeter, thermometer, ice Chart of specific heat values Chart of heat of fusion and heat of vaporization values Chart of selected standard molar enthalpies of formation	Lab Activities: Calorimetry to determine the heat of reaction of an exothermic reaction. and/Or Calorimetry to determine the heat of fusion of ice	Selected Chapter 15 QEP's Quiz- Energy and phase change Lab Report: Calorimetry to calculate Heat of Fusion of Ice or a Heat of Reaction Chapter 15 Test
6.5- Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy)	• Use Gibbs Equation to predict reaction spontaneity. • Distinguish between entropy (S) and enthalpy (H) • Establish that –□H indicates and exothermic		Discussion of spontaneous reaction and how they can be predicted with the Gibbs	

	process and +□S indicates an increase in entropy.		Equation (ex. Ice melting, explosions, combustion reactions)	
Science Inquiry Skills	Analyze and interpret results of scientific investigations.	Molar Volume Lab Handout	Class discussion	Molar Volume Lab Report
Science Inquiry Skills	. Communicate and apply the results of scientific investigations.			
Mathematical Skills	✓ Solve simple algebraic expressions. ✓ Measure with accuracy and precision (e.g., length, volume, mass, temperature, time) ✓ Use scientific notation, where appropriate. ✓ Use ratio and proportion to solve problems. ✓ Determine the correct number of significant figures. ✓ Determine percent error from experimental and accepted values.	Molar Volume Lab Handout	Class discussion of lab data	Molar Volume Lab Report
Reading Standards	**8.** 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. **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.	Molar Volume Handout		
Writing Standards	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes			Test Questions Molar Volume Lab Report

Unit: Solutions: 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?
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.	Cracolice & Peters Chapter 16, pp. 458-65 Cracolice & Peters Chapter 9, pp. 232-242 (ionic solutions) 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 16.11 on p. 465 Chart/Table: Solubilities of Ionic Compounds (Table 9.3, p. 252) Chart/Table: Solubility Rules for Ionic Compounds, p.253	Brainstorm different solute/solvent combinations Demonstrate various solute/solvent combinations to predict solubility Diagram the dissolution process of salt in water. Demonstration: Use light bulb conductivity apparatus to illustrate strong, weak, and nonelectrolytes Activity: Use Vernier conductivity probe to measure conductivity of solutions.	Chapter 16 Selected QEP's Quiz- Solutions Chapter 16 Test

		Conductivity apparatus with various s		
7.2- Calculate the 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 solutiont. • Determine the amount of solute in a given volume of solution. • Calculate the percent by mass of solute in solution. • Use dilution formula McVc = MdVd to calculate volume of concentrated solution needed to make a diluted solution by adding water. • If given the quantity of any species participating in a chemical reaction for which an equation can be written, find the quantity of any other species, either quantity being measured in grams, or volume of solution at a specified molarity.	Cracolice & Peters, Ch. 16 Salt, sugar, food coloring, graduated pipettes, volumetric flasks	Learning buddies Group problem solving Peer Teaching Demonstration: Using the dilution equation to make an aqueous food coloring solution Practical lab activity: Making solutions of accurate concentrations	Chapter 16 Selected QEP's Quiz- Concentration Problems Chapter 16 Test
7.3- Identify and explain the factors that affect the rate of dissolving (eg. temperature, concentration, surface area, pressure, and mixing)	• the rate at which a solid solute dissolves in a liquid solvent. • List and explain three factors that affect the rate at which a gas solute dissolves in a liquid solvent. • Explain how water can dissolve other polar solutes and some ionic solutes. Diagram how a polar water molecule "attacks" and dissociates soluble ionic compounds.	Cracolice & Peters, Chapter 16	Demonstration: Show the effect of temperature and surface area on the rate of dissolving salt in water	Chapter 16 Selected QEP's Quiz- Solutions Chapter 16 Test
7.4- Compare and contrast qualitatively the properties of solutions and pure solvents (colligative properties such as boiling point and freezing point)	• 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. (optional) • calculate the expected changes in freezing point and boiling point of an electrolyte solution.	Cracolice & Peters, Fun Lab: Making use of Colligative Properties to make ICE CREAM!	Fun Lab: Making use of colligative properties to make ICE CREAM!	Chapter 16 Selected QEP's Quiz- Solutions Chapter 16 Test

	(optional)			
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 collistions. • 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. • Interpret an energy- reaction graph. Identify the activated complex, activation energy, and □ E for reaction. List some common enzymes found in the human body.	Cracolice & Peters, Ch. 18 AP Chemistry Text, or other suitable college text. Graph: Energy-Reaction graph, Fig. 18.4, p. 532 Graph: Energy Profile of Catalyzed vs. Uncatalyzed Reaction, Fig. 18.5, p. 533	Guided energy diagram of a catalyzed vs. uncatatlyzed reactio	Quiz- Chapter 18 Test: Chapter 17, 18
Science Inquiry Skills	Design and conduct scientific investigations	Making a Solution Lab Activity	Making a Solution Lab Activity	Solution Lab Activity Write up. Quiz and Test questions
Mathematical Skills	Solve simple algebraic expressions ✓ Convert within a unit (e.g., centimeters to meters). ✓ Use common prefixes such as *milli-*, *centi-*, and *kilo-*. ✓ Use scientific notation, where appropriate. ✓ Use ratio and proportion to solve problems.	Cracolice & Peters, Chapter 16 Practice Problem Solving Worksheets	Class discussion Dipsticking White board	Quiz and Test Questions
Reading Standards		Cracolice & Peters, Chapter 16		
Writing Standards	Write informative/explanatory discussing 3 factors affecting Rate of Solution	Making a Solution Lab Activity	Group Work Class Discussion	Making a Solution Lab Activity Write up

Unit: Acids and Bases
Essential Questions
In what ways are common acids and bases used in Chemistry and daily life?
How does the Arrhenius Theory compare and contrast with the Bronsted theory of acids and bases?
How does a buffer work in terms of resistance to change in pH?
How is the pH scale used to determine the strength or concentration of acids and bases?
How does hydrogen ion concentration relate to the pH scale and acidic, basic, and neural solutions?
How are chemical indicators used to estimate pH?
How are acid dissociation constant (Ka) values used to indicate the strength of an acid

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
8.1 Define the Arrhenius theory of acids and bases in terms of the presence of hydronium and hydroxide ions in water and the Bronsted-Lowry theory of acids and bases in terms of proton donors and acceptors	• Recognize that an Acid releases hydronium ions and that a Base releases hydroxide ions in aqueous solution. • Recognize that the Bronsted Acid acts as a proton donor and the Bronsted Base acts as a proton acceptor. • Given the formula of an acid or base, write the formula of its conjugate base or acid. • Given formulas for Bronsted acid and the for Bronsted base, write the net-ionic equation for the reaction between them.	Cracolice & Peters, Ch. 17 Chart/Table: Relative Strengths of Acids and Bases, Table 17.1, p. 510 Cracolice & Peters, Ch. 17	Handout- Completing Arrhenius and Bronsted Acid/Base Equations Video- The Proton in Chemistry Demonstrate proton transfer with ball and stick models Overhead projection or powerpoint slide of proton transfer reactions.	Selected Chapter 17 QEP's. Quiz- Acids and Bases Chapter 17 Test
8.2 Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).	• Given a table of the relative strengths of acids and bases, arrange a group or acids or bases in order of increasing or decreasing strength. • List three strong acids and three weak acids • Identify an acid as "strong" or "weak" using the strength of acid chart and its Ka (acid dissociation constant)	Cracolice & Peters, Ch. 17 Chart/Table: Relative Strengths of Acids and Bases, Table 17.1, p. 510 Common household solutions: soda, baking soda, vinegar, cleaners,	Lab: Acid/Base Indicators, Estimating pH of common household solutions. Lab: Titration to determine the concentration of an unknown acid or base. Group Problem solving	Selected Chapter 17 QEP's. Quiz- Acids and Bases

	• Calculate the pH of a solution given its hydronium ion concentration, • Identify common household solutions and kitchen items as acid or base and estimate their pH. <u>Supplementary Skills:</u> • Given any one of the following, calculate the remaining three: hydronium ion concentration, hydroxide ion concentration, pH or pOH. • Perform non integer pH/pOH calculations	bleach, detergent etc. Calculator with logarithm function. Table/Chart: pH Values of Common Solutions pH meter or Vernier pH probeware (time permitting) Common indicators: litmus, universal, bromothymol blue	White Boards	Chapter 17 Test Acid Base Titration
8.3 – Explain how a buffer works	• Recognize the function of a buffer.	Cracolice and Peters, Chapter 18 Sample buffer solutions pH meter or Vernier pH probeware	Demonstrate how a buffer can resist pH changes with pH probeware	Selected Chapter 17 QEP's. Quiz- Acids and Bases Chapter 17 Test
Science Inquiry Skills	Design and conduct scientific investigations.	Acid Base Titration Lab	Group and class discusssion	Acid Base Titration Lab
Science Inquiry Skills	Analyze and interpret results of scientific investigations.	Acid Base Titration Lab		Acid Base Titration Lab
Mathematical Skills	✓ Solve simple algebraic expressions.	pH worksheet Acid Base Titration Lab	Class practice Problem Solving Worksheets	Acid Base Titration Lab
Writing Standards	. Write informative/explanatory texts, including the narration of historical events, scientific procedures/	Acid Base Titration Lab		Acid Base Titration Lab

	experiments, or technical processes ● Define the term titration and explain using an example. Include a discussion of the procedure. ● Explain how a buffer works.			

Unit: Chemical Equilibrium
Essential Question
1. What are the characteristics of an Equilibrium System
2. What are the forms of stress that can affect a system at equilibrium.
3. What are the equilibrium expression, the equilibrium constant, and the reaction quoitient?
4. What is the significance of the size of the K_{eq}?

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
7.6 Predict the shift in equilibrium when a system is subjected to stress	● Given an equilibrium reaction equation and value for equilibrium constant, identify the direction in which equilibrium is favored. ● Write an equilibrium expression for a reversible reaction using: $K = [products]^p/[reactants]^r$ ● Use LeChatelier's Principle to predict shift of equilibrium with a change in concentration, change in temperature, or change in pressure.	Cracolice & Peters, Ch 18	Practice worksheet for writing equilibrium expression. Demonstration: Bromothymol Blue pH shift. Practice Problems predicting a Le-Chatelier's shift	Test
Science Inquiry Skills	Make observations, raise questions, and formulate hypotheses.		LeChatelier's Principle Lab	Le Chatelier's Principle Lab
Mathematical Skills	● Solve simple algebraic expressions.	Cracolice & Peters, Ch 18	Equilibrium Expression Problem Solving Practice sheets	Quiz and Test Questions

Writing Skills	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.		Write an explanation of a specific equilibrium shift in response to a specific form of stress. Logical, sequential explanation using appropriate vocabulary are essential.	Quiz and Test Questions Le Chatelier's Lab Write up.

Unit: Redox Reactions

Framework Standard	Skills	Resources	Instructional Strategies	Assessments
8.4 Describe Oxidation and Reduction reactions and give some everyday examples, such as fuel burning and corrosion. Assign oxidation numbers in a reaction.	• Define redox in terms of loss and gain of electrons. • Be able to assign oxidation numbers to atoms in a redox reaction • Be able to categorize a reaction as redox vs. non-redox • Be able to write half-reactions and label as oxidation or reduction. (optional)	Cracolice & Peters, Ch.19	Practice worksheet Class discussion Dipsticking White boards	Quiz and Test questions
Mathematical Skills	• Solve simple algebraic expressions.	Practice Worksheets		Quiz and Test Questions