Lenoir County Public Schools
Curriculum Pacing Guide
Revision (August 2008)

Subject: Chemistry I **Grade Level:** 10-12 **1st/3rd** **9 weeks**

Time (approx teaching days)	**Major Concepts**	**Objective / Pacing**	**Text / Support Materials**
2	Matter Extensive property Intensive property Physical property Chemical property Physical change Chemical change Heterogeneous mixture Homogeneous mixture Filtration Distillation Element Compound Substance Chemical symbol Indicators of chemical change Law of conservation of mass	**Objectives** 1.03 Analyze experimental designs with regard to safety and use of safe procedures in laboratory investigations. 2.04 Identify substances using their physical properties • Melting point and boiling point • Density and solubility 5.03 Identify the indicators of chemical change. • Formation of a precipitate • Evolution of a gas • Color change • Absorption or release of heat **Questions addressed** • What is the difference between intensive and extensive properties of matter? Give examples of each. • What is a physical property of a substance? Give two examples. • What are the three common states of matter found on Earth? • What is a physical change? Give three examples. • What are the two common types of mixtures? What distinguishes one from the other? Provide examples of each. • What are some common methods used to separate mixtures? • What is the difference between an element and a compound? • What is a chemical change? How does it differ from a physical change? • How is a substance different from a mixture? • Why are chemical symbols and formulas used to represent elements and compounds? • What are some examples of chemical properties? • What are the four major indicators that a chemical change has occurred? • What does the law of conservation of mass state?	Chapter 2 – **Prentice Hall Chemistry** Text (pp. 39-55) Video: **American Chemical Society** *Starting with Safety* Video: **The World of Chemistry** *Chemistry* Video: **The World of Chemistry** *Color* Virtual Labs - **PH Chemistry** *#1: Flame Test for Metals* NCDPI Chemistry Curriculum Unit 1 *"Chemtools"*

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4	Measurement Scientific notation Accuracy Precision Percent error Accepted value Experimental value Significant figures SI system Dimensional analysis Conversion factor Density	**Objectives** 1.01 Design, conduct, and analyze investigations to answer questions related to chemistry. • Select and use appropriate measurement tools. • Collect and organize data in tables, charts, and graphs. • Analyze and interpret data. 2.04 Identify substances using their physical properties. • Density **Questions addressed** • Why is scientific notation used? • How is a number expressed in scientific notation? • What is the difference between accuracy and precision? • How is percent error calculated? • Why are significant figures so important in the reporting of measurements and experimental data? • What are the rules for determining the number of significant figures in a measurement? • What are the rules for determining significant figures in the results of mathematical operations? • What is the International System of Units? • What are the seven base units in the SI system? • What are the differences and similarities between the Celsius and Kelvin temperature scales? • What units are used to measure energy? • What is dimensional analysis? How are conversion factors used in dimensional analysis? • How is density calculated? • What generally happens to the density of a substance as its temperature increases?	Chapter 3 – **Prentice Hall Chemistry** Text (pp. 63-93) Video: **The World of Chemistry** *Measurement: The Foundation of Chemistry* Virtual Labs – **PH Chemistry** *#3: Counting by Measuring Mass* NCDPI Chemistry Curriculum Unit 1 *"Chemtools"*

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5	Atom Atomic theories Democritus Dalton's atomic theory Atomic nucleus Proton Neutron Electron Thomson Millikan Rutherford Chadwick Bohn model Gold-foil experiment Atomic number Atomic mass Mass number Isotope	**Objectives** 2.01 Analyze the historical development of the current atomic theory. • Early contributions: Democritus and Dalton • The discovery of the electron – Thomson and Millikan • The discovery of the nucleus, proton, and neutron – Rutherford and Chadwick 2.02 Examine the nature of atomic structure • Subatomic particles: proton, neutron, and electron • Mass number • Atomic number • Isotopes 2.02-1H Analyze and calculate the average atomic mass from relative abundance and actual isotopic mass (**HONORS**) **Questions addressed** • What is an atom? • What role did Democritus play in the development of atomic theory? • What are the four components of Dalton's atomic theory? How did his theory differ from that of Democritus? • What are the three main subatomic particles? What are their masses, charges, and locations within the atom? • What were the contributions of J. J. Thomson and Robert A. Millikan to atomic theory? • What were the contributions of Ernest Rutherford and James Chadwick to atomic theory? • What is the atomic number of an element? Mass number? • How is the number of neutrons in a particular isotope calculated? • How is average atomic mass for an element determined?	Chapter 4 – **Prentice Hall Chemistry** Text (pp. 101-119) Video: **Conceptual Physics** *Atoms* Virtual Labs – **PH Chemistry** *#4: Thomson Cathode Ray Tube Experiment* Virtual Labs – **PH Chemistry** *#5: Millikan Oil Drop Experiment* Virtual Labs – **PH Chemistry** *#6: Atomic Structure: Rutherford's Experiment* NCDPI Chemistry Curriculum Unit 2 *"Atomic Theory and Structure"*

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5	Energy levels Quantum Quantum mechanical model Atomic orbital Energy sublevel Electron configuration Aufbau principle Pauli exclusion principle Hund's rule Amplitude Wavelength Frequency Electromagnetic radiation Atomic emission spectrum Ground state Photons Heisenberg uncertainty principle	**Objectives** 2.01 Analyze the historical development of the current atomic theory. • The Bohr model • The quantum mechanical model 2.01-1H Apply quantum numbers to electron configurations. (**HONORS**) 4.01 Analyze the Bohr model in terms of electron energy in the hydrogen atom. • The spectrum of electromagnetic energy • Emission and absorption of electromagnetic energy as electrons change energy levels **Questions addressed** • How does the Bohr model of the atom differ from the Rutherford planetary model? • How do electrons move between energy levels in the Bohr model? • How does the quantum mechanical model of the atom differ from the Bohr model? • What are the four quantum numbers, and how do they describe the location of electrons in a given atom? • How is the maximum capacity of a given energy level calculated? • How many electrons can occupy each of the four sublevels? • How many electrons can occupy a single orbital? What must be true of two electrons occupying the same orbital? • What three rules govern the determination of the electron configuration for a given element? What does each state? • What are some exceptions to predicted electron configurations? • How are frequency and wavelength related? How is the speed o electromagnetic radiation determined? • How are atomic emission spectra used to identify elements? • How are atomic emission spectra produced? How do they relate to the movement of electrons within an atom? • What does the Heisenberg uncertainty principle state?	Chapter 5 – **Prentice Hall Chemistry** Text (pp. 127-145) Video: **The World of Chemistry** *The Atom* Video: **The World of Chemistry** *Signals from Within* Virtual Labs – **PH Chemistry** *#7: Atomic Emission Spectra* Virtual Labs – **PH Chemistry** *#8: Photoelectric Effect* NCDPI Chemistry Curriculum Unit 3 *"Electromagnetic Spectrum and Quantum Theory"*

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6	Dobereiner triad Mendeleev Moseley Periodic law Metals Nonmetals Metalloids Groups (families) Periods Representative elements Transition elements Inner transition elements Noble gases Atomic radius Ionic radius Ionization energy Electronegativity	**Objectives** 3.01 Analyze periodic trends in chemical properties and use the periodic table to predict properties of elements. • Groups (families) • Periods • Representative elements (main group) of transition elements • Electron configuration of energy levels • Ionization energy • Atomic and ionic radii • Electronegativity **Questions addressed** • How did chemists arrange elements into groups? • How did J. W. Dobereiner group the elements known at that time? • Why is Dmitri Mendeleev considered to be the father of the periodic table? • How did Mendeleev arrange elements in his table? • What was unique about Mendeleev's table? • What discovery allowed Henry Moseley to modify the work of Mendeleev? • How are elements arranged on the modern periodic table? • What are the three broad classes of elements? What are some propertie of each? • What information is provided on the periodic table? • What are periods on the periodic table? Groups? • What names are given to elements in Groups 1, 2, 17, and 18? • What groups of elements are found in the ***s*** block? ***p*** block? ***d*** block? ***f*** block? • What are the periodic and group trends for atomic radii? • What are the periodic and group trends for ionic radii? • What are the periodic and group trends for ionization energy?	Chapter 6 – **Prentice Hall Chemistry** Text (pp. 155-179) Video: **The World of Chemistry** *The Periodic Table* NCDPI Chemistry Curriculum Unit 4 *"Periodic Table and Trends"*

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		• What are the periodic and group trends for electronegativity? • How does the first ionization energy differ from the second and third ionization energies for a given element? • What is electronegativity? • How does the radius of an element's cation compare to the radius of its neutral atom? • How does the radius of an element's anion compare to the radius of its neutral atom?	
3	Valence electrons Electron (Lewis) dot structures Octet rule Ionic bonding Ionic compounds Cation Anion Formula unit Coordination number Metallic bonding Alloy	**Objectives** 2.06 Assess bonding in metals and ionic compounds as related to chemical and physical properties. **Questions addressed** • What are valence electrons? What is their significance in determining an element's chemical properties? • How can the periodic table be used to determine the number of valence electrons for a given element? • How are electron (Lewis) dot structures constructed? What do they represent? • What does the octet rule state? • How does a cation differ from an anion? • What does an atom do to form a cation or an anion? • What comprises an ionic compound? What holds it together? • What is a formula unit? How does it differ from a molecule? • What are some examples of ionic compounds? • What is the coordination number of an ion? • How are valence electrons arranged in metals? • What are metallic bonds? • What are the three most common arrangements of metallic ions in a crystal? Describe each one. • What are alloys and what is their significance in the everyday world?	Chapter 7 – **Prentice Hall Chemistry** Text (pp. 187-205) Video: **The World of Chemistry** *Chemical Bonds* NCDPI Chemistry Curriculum Unit 5 *"Bonding and Language of Chemistry"*

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5	Covalent bonding Molecular compound Diatomic molecule Molecular formula Structural formula Unshared pair Single covalent bond Double covalent bond Triple covalent bond Coordinate covalent bond Molecular orbital Bonding orbital Sigma bonds Pi bonds VSEPR theory Hybrid orbital Nonpolar covalent bond Polar covalent bond Van der Waals forces Dipole-dipole interaction Dispersion force	**Objectives** 2.07 Assess covalent bonding in molecular compounds as related to molecular geometry of chemical and physical properties. **Questions addressed** • What is a covalent bond? What types of atoms are typically joined in covalent bonds? • What is the physical characteristics of covalent compounds? • What is a diatomic molecule? What are the seven elements that exist in nature as diatomic molecules? • What is a molecular formula? • What is a structural formula? How does an electron (Lewis) dot structure represent a covalent compound? • What is an unshared pair? • What are the differences between single, double, and triple covalent bonds? • What is a coordinate covalent bond? Why do certain elements engage in this type of bonding? • What does bond dissociation energy correspond to the strength of a covalent bond? • What is a resonance structure? Give an example of a molecule that exhibits resonance. • What is the difference between a molecular orbital and a bonding orbital? • What is the difference between a sigma bond and a pi bond? • What does VSEPR theory state? How is it used to predict the shape of molecules? • What are the nine most common molecular shapes? • What are hybrid orbitals? Distinguish among sp^3, sp^2, and sp hybrid orbitals. • What is a nonpolar covalent bond?	Chapter 8 – **Prentice Hall Chemistry** Text (pp. 213-244) NCDPI Chemistry Curriculum Unit 6 *"Molecular Geometry"*

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	Hydrogen bond Network solid Bond dissociation energy Resonance structure	• What causes the polarity in polar covalent bonds? • What are intermolecular forces? How do they compare with ionic and covalent bonds? • What are the two categories of van der Waals forces? What causes each of these forces? • What is required for hydrogen bonding to occur? • What makes a network solid so much stronger than a typical covalent compound?	

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5	Monatomic ion Polyatomic ion Binary compound Acid Base Law of definite proportions Law of multiple proportions	**Objectives** 2.03 Apply the language and symbols of chemistry. • Name compounds using the IUPAC conventions. • Write formulas of simple compounds from their names. 5.02 Evaluate the law of conservation of matter • Apply and balance formulas. **Questions addressed** • How are cations and anions formed? • How does the charge of a cation relate to the group number in which it is located? • How can the group number of an anion be used to determine its charge? • How is the charge on a transition metal cation indicated in the cation name? • What are polyatomic ions? What kind of bonding occurs within a polyatomic ion? • What rules apply for naming multiple polyatomic ions that are composed of the same elements combined in different proportions? • What rules are used to determine the correct formula for an ionic compound? • How are binary ionic compounds named? • How are the formulas and names for ternary ionic compounds determined? • How are binary molecular compounds named? • How are the prefixes in the names of binary molecular compounds used to determine their formulas? • What are acids? What are bases? • What rules apply to the naming of acids? • How are the correct formulas for acids determined? • Are there any special rules that apply to naming and determining the formulas of bases?	Chapter 9 – **Prentice Hall Chemistry** Text (pp. 253-279) Virtual Labs – **PH Chemistry** *#2: Names and Formulas of Ionic Compounds* NCDPI Chemistry Curriculum Unit 5 *"Bonding and Language of Chemistry"*

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6	Mole Avogadro's number Representative particle Molar mass Avogadro's hypothesis STP Percent composition Empirical formula Molecular formula	**Objectives** 3.02 Apply the mole concept, Avogadro's number, and conversion factors to chemical calculations. • Particles to moles • Mass to moles • Volume of a gas to moles • Empirical and molecular formulas • Percent composition **Questions addressed** • How can matter be measured? • What is a mole? How many representative particles are in one mole of a substance? • What is Avogadro's number? • What is a representative particle of a particular substance? • How can numbers of representative particles be converted to moles, and vice versa? • What is molar mass? How is molar mass determined? • How are molar masses converted into moles, and vice versa? • What does the acronym **STP** stand for? What values does STP have? • What volume will one mole of any gas occupy under STP conditions? • What is the percent composition of an element in a compound? • From what two sources can data be derived to determine percent composition for a compound? • How is percent composition for element in a compound calculated? • What is the empirical formula for a compound? How does it differ from the molecular formula for that compound? • How is the empirical formula for a compound determined? • What does the molecular formula of a compound show? How is it determined?	Chapter 10 – **Prentice Hall Chemistry** Text (pp. 287-313) Video: **The World of Chemistry** *The Mole* NCDPI Chemistry Curriculum Unit 7 *"Mole Concept"*

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2	All concepts covered to date	**Lenoir County Public Schools Nine-Week Test Review and Test Administration**	Chapters 2-10 **Prentice Hall Chemistry**
2	Chemical equation Skeleton equation Reactants Products Catalyst	**Objectives** 5.02 Evaluate the Law of Conservation of Matter. • Write and balance formulas and equations. **Questions addressed** • What is the correct procedure for writing a chemical equation? • What is a skeleton equation? • What role does a catalyst play in a chemical reaction? • Why must a chemical equation be balanced? • What are the steps in balancing a chemical equation?	Chapter 11 – **Prentice Hall Chemistry** (Section 11.1) Text (pp. 321-329) NCDPI Chemistry Curriculum Unit 8 *"Chemical Reactions"*