

**Campbell County Schools**  
**Chemistry I**  
**1st Nine Weeks-at-a-Glance**

The following skills should be the focus for this Nine Weeks:

**Standard 1: Atomic Structure**

**CLE 3221.1.1** Compare and contrast historical models of the atom.

- **SPI 3221.1.1** Compare and contrast the major models of the atom.

**CLE 3221.INQ.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.

- **SPI 3221 Inq.1** Select a description or scenario that reevaluates and/or extends a scientific finding.
- **SPI 3221 Inq.2** Analyze the components of a properly designed scientific investigation.

**CLE 3221.1.3** Describe an atom in terms of its composition and electron characteristics.

- **SPI 3221.1.4** Determine the Lewis electron-dot structure or number of valence electrons for an atom of any main-group element from its atomic number or position in the periodic table.
- **SPI 3221.1.5** Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.

**CLE 3221.1.2** Compare and contrast historical models of the atom.

- **SPI 3221.1.2** Interpret the periodic table to describe an element's atomic makeup.
- **SPI 3221.1.3** Describe the trends found in the periodic table with respect to atomic size, ionization energy, electron affinity, or electronegativity.

**Standard 3: Interactions of Matter**

**CLE 3221.3.2** Analyze chemical and nuclear reactions.

- **SPI 3221.3.8** Describe radioactive decay through a balanced nuclear equation and through an analysis of the half-life concept.
- **SPI 3221.3.9** Compare and contrast nuclear fission and fusion.

**CLE 3221.Math.1** Understand the mathematical principles associated with the science of chemistry.

- **SPI 3221.Math.3** Interpret graphs that depict real-world phenomena.

**CLE 3221.3.4** Explain the Law of Conservation of Mass/Energy

- **SPI 3221.3.10** Relate the laws of conservation of mass/energy to thermal changes that occur during physical, chemical or nuclear processes.\*

**Standard 2: Matter and Energy**

**CLE 3221.2.1** Investigate the characteristic properties of matter.

- **SPI 3221.2.1** Distinguish among elements, compounds, solutions, colloids, and suspensions.
- **SPI 3221.2.3** Classify a solution as saturated, unsaturated, or supersaturated based on its composition and temperature and a solubility graph.
- **SPI 3221.2.4** Classify a property of change in matter as physical, chemical, or nuclear.

**CLE 3221.Math.1** Understand the mathematical principles associated with the science of chemistry.

**CLE 3221.Math.2** Utilize appropriate mathematical equations and processes to solve chemistry problems.

- **SPI 3221.Math.5** Use concepts of mass, length, area, and volume to estimate and solve real-world problems.

**CLE 3221.2.2** Explore the interactions between matter and energy

- **SPI 3221.2.5** Compare and contrast heat and temperature changes in chemical and physical processes.

**CLE 3221.Math.1** Understand the mathematical principles associated with the science of chemistry.

- **SPI 3221.Math.3** Interpret graphs that depict real-world phenomena.

**Standard 3: Interactions of Matter**

**CLE 3221.3.1** Investigate chemical bonding.

- **SPI 3221.3.1** Analyze ionic and covalent compounds in terms of how they form, names, chemical formulas, percent composition, and molar masses.

*\*Addressed more than one time in the school year.*

**Standards to be addressed throughout the nine weeks****Standard: Embedded Inquiry**

**CLE 3221.INQ.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.

- **SPI 3221 Inq.3** Determine appropriate tools to gather precise and accurate data.
- **SPI 3221 Inq.4** Evaluate the accuracy and precision of data.
- **SPI 3221 Inq.5** Defend a conclusion based on scientific evidence.
- **SPI 3221 Inq.6** Determine why a conclusion is free of bias.
- **SPI 3221 Inq.7** Compare conclusions that offer different, but acceptable explanations for the same set of experimental data.

**Standard: Technology and Engineering**

**CLE 3221.T/E.1** Explore the impact of technology on social, political, and economic systems.

**CLE 3221.T/E.3** Explain the relationship between the properties of a material and the use of the material in the application of a technology.

- **SPI 3221.T/E.1** Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.

**Standard: Mathematics**

- **SPI 3221.Math.1** Use real numbers to represent real-world applications (e.g., slope, rate of change, probability, and proportionality).
- **SPI 3221.Math.3** Interpret graphs that depict real-world phenomena.

### Embedded Inquiry Checks for Understanding

- ✓ **3221.Inq.1** Trace the historical development of a scientific principle or theory.
- ✓ **3221.Inq.2** Identify an answerable question and formulate a hypothesis to guide a scientific investigation.
- ✓ **3221.Inq.3** Design a simple experiment including appropriate controls.
- ✓ **3221.Inq.4** Perform and understand laboratory procedures directed at testing hypothesis.
- ✓ **3221.Inq.5** Select appropriate tools and technology to collect precise and accurate quantitative and qualitative data.
- ✓ **3221.Inq.6** Correctly read a thermometer, balance, metric ruler, graduated cylinder, pipette, and burette.
- ✓ **3221.Inq.7** Record observations and/or data using correct scientific units and significant figures.
- ✓ **3221.Inq.8** Export data into the appropriate form of data presentation (e.g., equation, table, graph, or diagram).
- ✓ **3221.Inq.9** Translate data into the correct units and dimension using conversion factors and scientific notation.
- ✓ **93221.Inq.10** Analyze information in a table, graph or diagram (e.g., compute the mean of a series of values or determine the slope of a line).
- ✓ **3221.Inq.11** If accepted values are known, calculate the percent error for an experiment.
- ✓ **3221.Inq.12** Determine the accuracy and precision of experimental results.
- ✓ **3221.Inq.13** Analyze experimental results and identify possible sources of bias or experimental error.
- ✓ **3221.Inq.14** Recognize, analyze, and evaluate alternative explanations for the same set of observations.
- ✓ **3221.Inq.15** Design a model based on the correct hypothesis that can be used for further investigation.

### Embedded Technology & Engineering Checks for Understanding

- ✓ **3221.1** Select appropriate tools to conduct a scientific inquiry.
- ✓ **3221.2** Apply the engineering design process to construct a prototype that meets developmentally appropriate specifications.
- ✓ **3221.3** Explore how the unintended consequences of new technologies can impact human and non-human communities.
- ✓ **3221.4** Present research on current bioengineering technologies that advance health and contribute to improvements in our daily lives.
- ✓ **3221.5** Design a series of multi-view drawings that can be used by other students to construct an adaptive design and test its effectiveness.

### Embedded Mathematics Checks for Understanding

- ✓ **3221.Math.1** Use a variety of appropriate notations (e.g., exponential, functional, square root).
- ✓ **3221.Math.2** Select and apply appropriate methods for computing with real numbers and evaluate the reasonableness of the results.
- ✓ **3221.Math.3** Apply algebraic properties, formulas, and relationships to perform operations on real-world problems (e.g., solve for density, determine the concentration of a solution in a variety of units: ppm, ppb, molarity, molality, and percent composition) calculate heats of reactions and phase changes, and manipulate gas law equations.
- ✓ **3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties, nuclear decay or half-life).
- ✓ **3221.Math.5** Analyze graphs to describe the behavior of functions (e.g., concentration of a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life).
- ✓ **3221.Math.6** Model real-world phenomena using functions and graphs.
- ✓ **3221.Math.7** Apply and interpret algebraic properties in symbolic manipulation (e.g., density, concentration of a solution, chemical equations, effect of volume, temperature or pressure on behavior of a gas, percent composition of elements in a compound, molar mass, number of moles, and molar volume, amount of products or reactants given mole, molarity, volume at STP or mass amounts, heat loss or gain using mass, temperature change and specific heat, and half-life of an isotope).
- ✓ **3221.Math.8** Apply and communicate measurement units, concepts and relationships in algebraic problem-solving situations.
- ✓ **3221.Math.9** Select appropriate units, scales, and measurement tools for problem situations involving proportional reasoning and dimensional analysis.
- ✓ **3221.Math.10** Select, construct, and analyze appropriate graphical representations for a data set.
- ✓ **3221.Math.11** Identify and solve different types of stoichiometry problems (e.g., volume at STP to mass, moles to mass, molarity).
- ✓ **3221.Math.12** Calculate the amount of product expected in an experiment and determine percent yield.
- ✓ **3221.Math.13** Convert among the quantities of a substance: mass, number of moles, number of particles, molar volume at STP.

### Standard 1 – Atomic Structure Checks for Understanding

- ✓ **3221.1.1** Identify the contributions of major atomic theorists: Bohr, Chadwick, Dalton, Planck, Rutherford, and Thomson.
- ✓ **3221.1.2** Compare the Bohr model and the quantum mechanical electron-cloud models of the atom.
- ✓ **3221.1.3** Draw Bohr models of the first 18 elements.
- ✓ **3221.1.4** Interpret a Bohr model of an electron moving between its ground and excited states in terms of the absorption or emission of energy.
- ✓ **3221.1.5** Use the periodic table to identify an element as a metal, nonmetal, or metalloid.
- ✓ **3221.1.6** Apply the periodic table to determine the number of protons and electrons in a neutral atom.
- ✓ **3221.1.7** Determine the number of protons and neutrons for a particular isotope of an element.
- ✓ **93221.1.8** Explain the formation of anions and cations, and predict the charge of an ion formed by the main-group elements.
- ✓ **3221.1.9** Sequence selected atoms from the main-group elements based on their atomic or ionic radii.
- ✓ **3221.1.10** Sequence selected atoms from the main-group elements based on first ionization energy, electron affinity, or electronegativity.
- ✓ **3221.1.11** Determine an atom's Lewis electron-dot structure or number of valence electrons from an element's atomic number or position in the periodic table.
- ✓ **3221.1.12** Represent an atom's electron arrangement in terms of orbital notation, electron configuration notation, and electron-dot notation.
- ✓ **3221.1.13** Compare s and p orbitals in terms of their shape, and order the s, p, d and f orbitals in terms of energy and number of possible electrons.

## Standard 2 – Matter and Energy Checks for Understanding

- ✓ **3221.2.1** Identify a material as an element, compound or mixture; identify a mixture as homogeneous or heterogeneous; and/or identify a mixture as a solution, colloid or suspension.
- ✓ **3221.2.2** Identify the solute and solvent composition of a solid, liquid or gaseous solution.
- ✓ **3221.2.3** Express the concentration of a solution in units of ppm, ppb, molarity, molality, and percent composition.
- ✓ **3221.2.4** Describe how to prepare solutions of given concentrations expressed in units of ppm, ppb, molarity, molality, and percent composition.
- ✓ **3221.2.5** Investigate factors that affect the rate of solution.
- ✓ **3221.2.6** Describe how to prepare a specific dilution from a solution of known molarity.
- ✓ **3221.2.7** Determine the colligative properties of a solution based on the molality and freezing point or boiling points of the solvent.
- ✓ **3221.2.8** Use a solubility graph, composition of a solution and temperature to determine if a solution is saturated, unsaturated or supersaturated.
- ✓ **3221.2.9** Classify properties and changes in matter as physical, chemical, or nuclear.
- ✓ **3221.10** Use calorimetry to: identify unknown substances through specific heat, determine the heat changes in physical and chemical changes, determine the mass of an object, and determine the change in temperature of a material.
- ✓ **3221.2.11** Perform calculations on heat of solvation, heat of reaction, and heat of formation, and heat of phase change.
- ✓ **3221.2.12** Use particle spacing diagrams to identify solids, liquids, or gases.
- ✓ **3221.2.13** Distinguish among solid, liquid, and gaseous states of a substance in terms of the relative kinetic energy of its particles.
- ✓ **3221.2.14** Use a phase diagram to correlate changes in temperature and energy with phases of matter.
- ✓ **3221.2.15** Graph and interpret the results of experiments that explore relationships among pressure, temperature, and volume of gases.
- ✓ **3221.2.16** Solve gas law problems.

## Standard 3 – Interactions of Matter Checks for Understanding

- ✓ **3221.3.1** Determine the type of chemical bond that occurs in a chemical compound.
- ✓ **3221.3.2** Differentiate between ionic and covalent bond models.
- ✓ **3221.3.3** Identify the chemical formulas of common chemical compounds.
- ✓ **3221.3.4** Employ a table of polyvalent cations and polyatomic ions to name and describe the chemical formula of ionic compounds.
- ✓ **3221.3.5** Convert percent composition information into the empirical or molecular formula of a compound.
- ✓ **3221.3.6** Apply information about the molar mass, number of moles, and molar volume to the number of particles of the substance.
- ✓ **3221.3.7** Balance an equation for a chemical reaction.
- ✓ **3221.3.8** Classify a chemical reaction as composition, decomposition, single replacement, double replacement, and combustion.
- ✓ **3221.3.9** Use activity series or solubility product table information to predict the products of a chemical reaction.
- ✓ **3221.3.10** Predict the products of a neutralization reaction involving inorganic acids and bases.
- ✓ **3221.3.11** Interpret a chemical equation to determine molar ratios.
- ✓ **3221.3.12** Convert between the following quantities of a substance: mass, number of moles, number of particles, and molar volume at STP.
- ✓ **3221.3.13** Solve different types of stoichiometry problems (e.g., volume at STP to mass, moles to mass, molarity).
- ✓ **3221.3.14** Determine the amount of expected product in an experiment and calculate percent yield.
- ✓ **3221.3.15** Calculate the amount of heat lost or gained by a substance based on its mass, change in temperature, and specific heat during physical and chemical processes.
- ✓ **93221.3.16** Research applications of thermal changes in nuclear reactions.
- ✓ **93221.3.17** Identify a substance as an acid or base according to its formula.
- ✓ **93221.3.18** Investigate the acidity/basicity of substances with various indicators.
- ✓ **93221.3.19** Write the nuclear equation involving alpha or beta particles based on the mass number of the parent isotope and complete symbols for alpha or beta emissions.
- ✓ **93221.3.20** Determine the half-life of an isotope by examining a graph or with an appropriate equation.
- ✓ **93221.3.21** Write a balanced nuclear equation to compare nuclear fusion and fission.
- ✓ **93221.3.22** Describe the benefits and hazards of nuclear energy.