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Correlation with the

Tennessee Curriculum Standards

Secondary School Science

Approved January 25, 2008

Physical Science

Standard 1

Matter

Conceptual Strand 1

The composition and structure of matter is known, and it behaves according to principles that are generally understood.

Guiding Question 1

How does the structure of matter determine its chemical and physical properties?

Course Level Expectations

1. Explore matter in terms of its physical and chemical properties.

   → **LAB** *Chemical Matter* "Chemical and Physical Properties"

2. Describe the structure and arrangement of atomic particles.

   → *All Labs*

3. Characterize and classify elements based on their atomic structure.

   → **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"

   → **MISCELLANEOUS** *Main Groups* "Alkali Metals"

   → **MISCELLANEOUS** *Main Groups* "Alkaline Earth Metals"

   → **MISCELLANEOUS** *Transition Metals* "Elements of the d- and f-Blocks"

→ **Miscellaneous** *Main Groups* "Boron Group"

→ **Miscellaneous** *Main Groups* "Carbon Group"

→ **Miscellaneous** *Main Groups* "Nitrogen Group"

→ **Miscellaneous** *Main Groups* "Oxygen Group"

→ **Miscellaneous** *Main Groups* "Halogens"

→ **Miscellaneous** *Main Groups* "Noble Gases"

4. Investigate chemical and physical changes.

→ **Lab** *Liquids & Solids* "The Melting Transition"

→ **Demonstration** *Chemical Matter* "Do physical changes affect the amount of matter?"

→ **Demonstration** *Kinetics* "What does a chemical reaction look like at the molecular level?"

5. Evaluate pure substances and mixtures.

→ **Miscellaneous** *Chemical Matter* "The Types of Mixtures"

6. Distinguish between common ionic and covalent compounds.

→ **Lab** *Chemical Bonding* "Polar Bonds and Molecules"

→ **Lab** *Chemical Bonding* "Classifying by Bond Polarity"

→ **Stockroom** *Inorganic* "Top 10 Inorganic Chemicals"

7. Construct chemical formulas for common compounds.

→ **Stockroom** *Inorganic* "Top 10 Inorganic Chemicals"

→ **Stockroom** *Organic* "Top 10 Organic Chemicals"

→ *Many Stockroom Pages*

8. Investigate relationships among the pressure, temperature, and volume of gases and liquids.

→ **Lab** *Gases* "The Density of Liquids and Gases"

→ **Miscellaneous** *Liquids & Solids* "Compressibility"

→ **Lab** *Gases* "The Pressure-Volume Relationship"

→ **Demonstration** *Gases* "Do gases have a definite volume?"

→ **Lab** *Gases* "The Pressure-Temperature Relationship"

10. Distinguish among acids, bases, and neutral substances.

→ **Lab** *Acids & Bases* "Strong Acids"

→ **Lab** *Acids & Bases* "Structure and Acidity"

Checks for Understanding

1. Distinguish among solids, liquids, gases, and plasmas.

→ **Lab** *Chemical Matter* "Comparing the States of Matter"

→ **Lab** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases"

2. Describe and illustrate the physical differences among solids, liquids, and gases in terms of their mass, volume, density, shape, and particle arrangement.

→ **Lab** *Chemical Matter* "Comparing the States of Matter"

→ **Lab** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases"

→ **Miscellaneous** *Liquids & Solids* "Compressibility"

3. Use appropriate units to measure or calculate the mass and volume of substances.

→ **Lab** *Chemical Matter* "Chemical and Physical Properties"

6. Identify substances as homogeneous or heterogeneous mixtures.

→ **Miscellaneous** *Chemical Matter* "The Types of Mixtures"

8. List the three major subatomic particles and distinguish among their location, charges, and relative masses.

→ **Lab** *Atoms* "Nuclei and Electrons"

9. Distinguish between atomic number and atomic mass.

→ **LAB** *Atoms* "Nuclei and Electrons"

11. Identify the number of protons, neutrons, and electrons in an atom of an isotope based on its atomic number and atomic mass.

→ **LAB** *Atoms* "Nuclei and Electrons"

12. Know the chemical symbols for the common elements.

→ **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"

→ **MISCELLANEOUS** *Main Groups* "Alkali Metals"

→ **MISCELLANEOUS** *Main Groups* "Alkaline Earth Metals"

→ **MISCELLANEOUS** *Transition Metals* "Elements of the d- and f-Blocks"

→ **MISCELLANEOUS** *Main Groups* "Boron Group"

→ **MISCELLANEOUS** *Main Groups* "Carbon Group"

→ **MISCELLANEOUS** *Main Groups* "Nitrogen Group"

→ **MISCELLANEOUS** *Main Groups* "Oxygen Group"

→ **MISCELLANEOUS** *Main Groups* "Halogens"

→ **MISCELLANEOUS** *Main Groups* "Noble Gases"

16. Classify a substance as an element or compound based on its chemical formula or symbol.

→ **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"

→ **MISCELLANEOUS** *Chemical Matter* "The Types of Compounds"

21. Use models to represent chemical reactions as synthesis, decomposition, single-replacement, and double-replacement.

→ **DEMONSTRATION** *Solutions* "How do salts dissolve in water?"

24. Observe and measure temperature changes to distinguish between endothermic and exothermic reactions.

→ **LAB** *Kinetics* "Reactive Collisions Between Molecules"

→ **LAB** *Kinetics* "Examining a Reaction Mechanism"

→ **Lab** *Equilibria* "Equilibrium and Temperature"

25. Conduct, analyze, and communicate the results of an experiment that demonstrates the relationship between pressure and volume of a gas.

→ **Lab** *Gases* "The Pressure-Volume Relationship"

→ **Demonstration** *Gases* "What is Boyle's Law?"

State Performance Indicators

1. Distinguish among states of matter in terms of energy, volume, shape, particle arrangement, and phase changes.

→ **Lab** *Chemical Matter* "Comparing the States of Matter"

→ **Lab** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases"

→ **Miscellaneous** *Liquids & Solids* "Compressibility"

2. Name, measure, and describe the physical properties of substances.

→ **Lab** *Chemical Matter* "Chemical and Physical Properties"

3. Compare different types of mixtures.

→ **Miscellaneous** *Chemical Matter* "The Types of Mixtures"

4. Distinguish between examples of common elements and compounds.

→ **Miscellaneous** *Chemical Matter* "Examples of Chemical Elements"

→ **Miscellaneous** *Chemical Matter* "The Types of Compounds"

6. Determine the composition of an atom and the characteristics of its subatomic particles.

→ **Lab** *Atoms* "Nuclei and Electrons"

7. Explain the interrelationship between pressure, temperature, and volume of gases.

→ **Lab** *Gases* "The Pressure-Volume Relationship"

→ **Lab** *Gases* "The Pressure-Temperature Relationship"

→ **Miscellaneous** *Gases* "The Universality of the Ideal Gas Law"

10. Classify chemical bonds in a compound as ionic or covalent.

→ **Lab** *Chemical Bonding* "Polar Bonds and Molecules"

→ **Lab** *Chemical Bonding* "Classifying by Bond Polarity"

12. Identify the reactants and products in a chemical equation, and balance equations using proper coefficients.

→ **Lab** *Kinetics* "Examining a Reaction Mechanism"

15. Explain the Law of Conservation of Mass/Energy in terms of a balanced chemical equation.

→ **Lab** *Kinetics* "Reactive Collisions Between Molecules"

16. Distinguish between endothermic and exothermic reactions.

→ **Lab** *Kinetics* "Reactive Collisions Between Molecules"

→ **Lab** *Kinetics* "Examining a Reaction Mechanism"

→ **Lab** *Equilibria* "Equilibrium and Temperature"

17. Identify a substance as acidic, basic, or neutral based on its pH or response to an indicator or instrument.

→ **Lab** *Acids & Bases* "Strong Acids"

→ **Lab** *Acids & Bases* "Structure and Acidity"

Standard 2
Energy

Conceptual Strand 2
Various forms of energy are constantly being transformed into other types without any net loss of energy from the system.

Guiding Question 2
What basic energy related ideas are essential for understanding the dependency of the natural and man-made worlds on energy?

Course Level Expectations

3. Examine the applications and effects of heat energy.

→ **Lab** *Gases* "The Meaning of Temperature"

→ **Demonstration** *Chem. Thermodyn.* "Do all spontaneous processes involve a visible increase of disorder?"

6. Investigate the Law of Conservation of Energy.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

Checks for Understanding

6. Identify the boiling and freezing points of water in the Celsius, Fahrenheit, and Kelvin temperature scales.

→ **Lab** *Gases* "Temperature Scales in Chemistry"

8. Investigate the relationships among kinetic, potential, and total energy within a closed system.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

State Performance Indicators

4. Identify the boiling and freezing points of water using Celsius, Fahrenheit, or Kelvin scales.

→ **Lab** *Gases* "Temperature Scales in Chemistry"

8. Identify a scenario that illustrates the Law of Conservation of Energy.

→ **Demonstration** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

11. Solve problems regarding heat, mass, specific heat capacity, and temperature change ($Q=mC\Delta T$).

→ **Lab** *Thermochemistry* "Specific Heat"

Chemistry I

Standard 1
Atomic Structure

Conceptual Strand 1
Atomic theory is the foundation for understanding the interactions and changes in matter.

Guiding Question 1
How does the structure of matter determine its chemical and physical properties?

Course Level Expectations

3. Describe an atom in terms of its composition and electron characteristics.

→ **Lab** *Atoms* "The Electron Cloud of an Argon Atom"

Checks for Understanding

2. Compare the Bohr model and the quantum mechanical electron-cloud models of the atom.

→ **Lab** *Atoms* "The Electron Cloud of an Argon Atom"

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.

→ **Lab** *Chemical Bonding* "Comparing Conceivable Shapes for a Molecule"

12. Represent an atom's electron arrangement in terms of orbital notation, electron configuration notation, and electron-dot notation.

→ **Lab** *Atoms* "d-Orbitals"

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.

→ **Lab** *Atoms* "s- and p-Orbitals"

→ **Demonstration** *Atoms* "What does a hydrogen atom look like?"

→ **Lab** *Atoms* "Atomic Orbitals"

→ **Demonstration** *Atoms* "Is an s-orbital the same for all elements?"

→ **Demonstration** *Atoms* "How do p-orbitals differ from each other?"

State Performance Indicators

1. Compare and contrast the major models of the atom (e.g., Democritus, Thomson, Rutherford, Bohr, and the quantum mechanical model).

→ **Lab** *Atoms* "The Electron Cloud of an Argon Atom"

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.

→ **Lab** *Chemical Bonding* "Comparing Conceivable Shapes for a Molecule"

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.

⟶ **LAB** *Atoms* "s- and p-Orbitals"

⟶ **DEMONSTRATION** *Atoms* "Is an s-orbital the same for all elements?"

⟶ **DEMONSTRATION** *Atoms* "How do p-orbitals differ from each other?"

⟶ **LAB** *Atoms* "d-Orbitals"

⟶ **LAB** *Atoms* "Atomic Orbitals"

Standard 2
Matter and Energy

Conceptual Strand 2
The properties of matter determine how it interacts with energy.

Guiding Question 2
What is the relationship between matter and energy?

Course Level Expectations

1. Investigate the characteristic properties of matter.

   ⟶ *All Labs*

2. Explore the interactions between matter and energy.

   ⟶ *Many Labs*

3. Apply the kinetic molecular theory to describe solids, liquids, and gases.

   ⟶ **LAB** *Liquids & Solids* "Molecular Motion in the States of Matter"

4. Investigate characteristics associated with the gaseous state.

   ⟶ **LAB** *Gases* "Gas Pressure"

   ⟶ **DEMONSTRATION** *Gases* "Do gases have a definite volume?"

   ⟶ **LAB** *Gases* "The Ability of Gases to Mix"

Checks for Understanding

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.

→ **MISCELLANEOUS** *Chemical Matter* "The Types of Mixtures"

2. Identify the solute and solvent composition of a solid, liquid or gaseous solution.

→ **LAB** *Solutions* "Concentration of a Dissolved Pesticide"

3. Express the concentration of a solution in units of ppm, ppb, molarity, molality, and percent composition.

→ **LAB** *Solutions* "Concentration of a Dissolved Pesticide"

5. Investigate factors that affect the rate of solution.

→ **DEMONSTRATION** *Solutions* "How do salts dissolve in water?"

9. Classify properties and changes in matter as physical, chemical, or nuclear.

→ **LAB** *Chemical Matter* "Chemical and Physical Properties"

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.

→ **LAB** *Thermochemistry* "Specific Heat"

11. Perform calculations on heat of solvation, heat of reaction, and heat of formation, and heat of phase change.

→ **LAB** *Kinetics* "Reactive Collisions Between Molecules"

→ **LAB** *Kinetics* "Examining a Reaction Mechanism"

→ **LAB** *Equilibria* "Equilibrium and Temperature"

12. Use particle spacing diagrams to identify solids, liquids, or gases.

→ **LAB** *Chemical Matter* "Comparing the States of Matter"

→ **LAB** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases"

13. Distinguish among solid, liquid, and gaseous states of a substance in terms of the relative kinetic energy of its particles.

→ **LAB** *Liquids & Solids* "Molecular Motion in the States of Matter"

15. Graph and interpret the results of experiments that explore relationships among pressure, temperature, and volume of gases.

→ **LAB** *Gases* "The Pressure-Volume Relationship"

→ **LAB** *Gases* "The Pressure-Temperature Relationship"

16. Solve gas law problems.

→ **MISCELLANEOUS** *Gases* "The Universality of the Ideal Gas Law"

State Performance Indicators

1. Distinguish among elements, compounds, solutions, colloids, and suspensions.

→ **MISCELLANEOUS** *Chemical Matter* "Examples of Chemical Elements"

→ **MISCELLANEOUS** *Chemical Matter* "The Types of Compounds"

→ **MISCELLANEOUS** *Chemical Matter* "The Types of Mixtures"

2. Identify properties of a solution: solute and solvent in a solid, liquid or gaseous solution; procedure to make or determine the concentration of a solution in units of ppm, ppb, molarity, molality, percent composition, factors that affect the rate of solution, and colligative properties.

→ **DEMONSTRATION** *Solutions* "How do salts dissolve in water?"

→ **LAB** *Solutions* "Concentration of a Dissolved Pesticide"

3. Classify a solution as saturated, unsaturated, or supersaturated based on its composition and temperature and a solubility graph.

→ **MISCELLANEOUS** *Solutions* "Molarity vs. Molality"

5. Compare and contrast heat and temperature changes in chemical and physical processes.

→ **LAB** *Gases* "The Meaning of Temperature"

→ **LAB** *Thermochemistry* "Thermal Energy"

6. Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.

→ **LAB** *Chemical Matter* "Comparing the States of Matter"

→ **LAB** *Chemical Matter* "Side-by-Side Comparison of Solids, Liquids, and Gases"

7. Predict how changes in volume, temperature, and pressure affect the behavior of a gas.

→ **LAB** *Gases* "The Pressure-Volume Relationship"

→ **LAB** *Gases* "The Pressure-Temperature Relationship"

→ **DEMONSTRATION** *Gases* "What is Boyle's Law?"

Standard 3
Interactions of Matter

Conceptual Strand 3
Interactions between matter generate substances with new physical and chemical properties.

Guiding Question 3
What types of interactions between matter generate new substances?

Course Level Expectations

1. Investigate chemical bonding.

   → **LAB** *Chemical Bonding* "Electron Sharing in Molecules"

   → **LAB** *Chemical Bonding* "Energetics of Covalent Bonding"

   → **LAB** *Chemical Bonding* "Polar Bonds and Molecules"

   → **LAB** *Chemical Bonding* "Classifying by Bond Polarity"

2. Analyze chemical and nuclear reactions.

   → **DEMONSTRATION** *Kinetics* "What does a chemical reaction look like at the molecular level?"

   → **LAB** *Kinetics* "Reactive Collisions Between Molecules"

   → **LAB** *Kinetics* "Examining a Reaction Mechanism"

4. Explain the law of conservation of mass/energy.

   → **DEMONSTRATION** *Thermochemistry* "What is the energy of a vibrating diatomic molecule?"

Checks for Understanding

1. Determine the type of chemical bond that occurs in a chemical compound.

   → **LAB** *Chemical Bonding* "Classifying by Bond Polarity"

2. Differentiate between ionic and covalent bond models.

→ **Lab** *Chemical Bonding* "Exploring Ionic Interactions"

→ **Lab** *Chemical Bonding* "Energetics of Covalent Bonding"

3. Identify the chemical formulas of common chemical compounds.

→ **Stockroom** *Inorganic* "Top 10 Inorganic Chemicals"

→ **Stockroom** *Organic* "Top 10 Organic Chemicals"

4. Employ a table of polyvalent cations and polyatomic ions to name and describe the chemical formula of ionic compounds.

→ **Lab** *Chemical Bonding* "Polyatomic Ions"

8. Classify a chemical reaction as composition, decomposition, single replacement, double replacement, and combustion.

→ **Demonstration** *Solutions* "How do salts dissolve in water?"

13. Solve different types of stoichiometry problems (e.g., volume at STP to mass, moles to mass, molarity).

→ **Lab** *Solutions* "Concentration of a Dissolved Pesticide"

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.

→ **Lab** *Thermochemistry* "Specific Heat"

17. Identify a substance as an acid or base according to its formula.

→ **Lab** *Acids & Bases* "Strong Acids"

→ **Lab** *Acids & Bases* "Structure and Acidity"

18. Investigate the acidity/basicity of substances with various indicators.

→ **Miscellaneous** *Acids & Bases* "pH Indicator"

State Performance Indicators

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

→ **Lab** *Chemical Matter* "Naming Molecular Compounds"

→ **Lab** *Chemical Bonding* "Energetics of Covalent Bonding"

→ **LAB** *Chemical Bonding* "Polar Bonds and Molecules"

→ **LAB** *Chemical Bonding* "Classifying by Bond Polarity"

2. Identify the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.

→ **DEMONSTRATION** *Solutions* "How do salts dissolve in water?"

6. Identify and solve stoichiometry problems: volume at STP to mass, moles to mass, and molarity.

→ **LAB** *Solutions* "Concentration of a Dissolved Pesticide"

7. Classify substances as acids or bases based on their formulas and how they react with various indicators.

→ **LAB** *Acids & Bases* "Structure and Acidity"

Chemistry II

Standard 1
Structure of Matter

Conceptual Strand 1
Atomic theory is the foundation for understanding the interactions and changes in matter.

Guiding Question 1
How does the structure of matter determine its chemical and physical properties?

Course Level Expectations

1. Explain and illustrate the arrangement of electrons surrounding an atom.

→ **LAB** *Atoms* "The Electron Cloud of an Argon Atom"

2. Relate the arrangement of electrons surrounding an atom with observed periodic trends.

→ **LAB** *Atoms* "s- and p-Orbitals"

3. Describe the structure, shape, and characteristics of polyatomic ions, ionic and molecular compounds.

→ **LAB** *Chemical Bonding* "Polyatomic Ions"

Checks for Understanding

4. Describe the arrangement of electrons in an atom using orbital diagrams, electron configuration notation, and Lewis structures.

→ **Demonstration** *Atoms* "What does a hydrogen atom look like?"

→ **Lab** *Atoms* "Atomic Orbitals"

→ **Demonstration** *Atoms* "Is an s-orbital the same for all elements?"

→ **Demonstration** *Atoms* "How do p-orbitals differ from each other?"

→ **Lab** *Atoms* "d-Orbitals"

7. Describe to correlation between the principle quantum number of the valence electrons and the atomic and ionic radii, ionization energy, and electron affinities of an atom or ion.

→ **Lab** *Atoms* "s- and p-Orbitals"

8. Use Lewis structures to illustrate the structure, shape, and characteristics of polyatomic ions, ionic and molecular compounds.

→ **Lab** *Chemical Bonding* "Comparing Conceivable Shapes for a Molecule"

→ *Many Stockroom Pages*

9. Illustrate the shape of molecular compounds using VSEPR theory.

→ **Lab** *Chemical Bonding* "VSEPR Theory"

→ **Lab** *Chemical Bonding* "Comparing Conceivable Shapes for a Molecule"

10. Determine the polarity of a molecular compound by examining its bond dipoles and shape.

→ **Lab** *Chemical Bonding* "Dipole Moments"

11. Apply Lewis structures and formal charge analysis to determine if a compound or polyatomic ion forms resonance structures.

→ **Lab** *Chemical Bonding* "Polyatomic Ions"

13. Illustrate how sigma and pi bonds form between atoms in a molecular compound.

→ **Lab** *Organic Chemistry* "Isomers of Alkenes and Alkynes"

14. Draw the basic functional groups found in organic molecules.

→ **Lab** *Organic Chemistry* "Functional Groups"

15. Draw the structural formulas of simple organic molecules.

→ **LAB** *Organic Chemistry* "Isomers of the Alkanes"

→ **LAB** *Organic Chemistry* "Straight-Chain Alkanes"

→ **LAB** *Organic Chemistry* "Cyclic Hydrocarbons"

Standard 2

States of Matter

Conceptual Strand 2
Kinetic-molecular theory and intermolecular forces are the basis for solid, liquid, gas, and solution phenomena**.**

Guiding Question 2
How does the interaction between ions and molecules determine the physical state and characteristics of matter?

Course Level Expectations

1. Explain the kinetic-molecular theory.

   → **LAB** *Gases* "Gas Pressure"

2. Determine the intermolecular forces that exist between ions and molecules.

   → **LAB** *Liquids & Solids* "Intermolecular Forces"

3. Explain how the physical characteristics of matter are governed by kinetic molecular theory and intermolecular forces.

   → **LAB** *Liquids & Solids* "Molecular Motion in the States of Matter"

   → **LAB** *Liquids & Solids* "Intermolecular Forces"

Checks for Understanding

1. Correlate the kinetic-molecular theory with the motion of particles within a substance.

   → **LAB** *Liquids & Solids* "Intermolecular Forces"

2. Explain the effect of heat on temperature in terms of the motion of the particles within the substance.

   → **LAB** *Gases* "The Meaning of Temperature"

   → **LAB** *Gases* "Mean Speed and Temperature"

3. Explain how the motion of gas molecules affects the pressure.

→ **LAB** *Gases* "Gas Pressure"

4. Explain the effects of temperature changes on the pressure of a gas.

→ **LAB** *Gases* "The Pressure-Temperature Relationship"

5. Explain the effects of pressure changes on the volume of a gas.

→ **LAB** *Gases* "The Pressure-Volume Relationship"

→ **DEMONSTRATION** *Gases* "What is Boyle's Law?"

7. Determine the rates of effusion of gas molecules using Graham's Law of Effusion.

→ **LAB** *Gases* "Effusion"

9. Determine the types of intermolecular interactions that occur in a pure substance or between the components of a mixture.

→ **LAB** *Liquids & Solids* "Intermolecular Forces"

10. Compare the strengths of intermolecular forces between ions, molecules, and ion-molecule mixtures.

→ **LAB** *Liquids & Solids* "Dipole-Dipole Forces"

11. Correlate the strength of intermolecular force with the viscosity, surface tension and physical state of the substance at a given temperature.

→ **LAB** *Liquids & Solids* "Intermolecular Forces"

12. Explain the role of intermolecular forces in determining the vapor pressure, volatility and boiling point of a substance.

→ **DEMONSTRATION** *Liquids & Solids* "How does temperature affect the vapor pressure?"

→ **LAB** *Liquids & Solids* "Intermolecular Forces"

→ **DEMONSTRATION** *Liquids & Solids* "What does a liquid-vapor equilibrium look like?"

Standard 3

Reactions

Conceptual Strand 3

Chemical reactions can be investigated and described through their stoichiometric, kinetic, equilibrium, and thermodynamic characteristics.

Guiding Question 3
How can the stoichiometric, kinetic, equilibrium, and thermodynamic characteristics of a chemical reaction lead to a further understanding of reaction process?

Course Level Expectations

3. Analyze the kinetics of a chemical reaction.

    ⟶ **DEMONSTRATION** *Kinetics* "What does a chemical reaction look like at the molecular level?"

    ⟶ **LAB** *Kinetics* "Reactive Collisions Between Molecules"

    ⟶ **LAB** *Kinetics* "Examining a Reaction Mechanism"

4. Describe parameters of chemical equilibria.

    ⟶ **LAB** *Equilibria* "Equilibrium and Temperature"

    ⟶ **LAB** *Equilibria* "Equilibrium and Pressure"

5. Explain the thermodynamics of a chemical reaction.

    ⟶ **LAB** *Kinetics* "Reactive Collisions Between Molecules"

Checks for Understanding

2. Use a solubility chart to predict products and write net ionic reactions that identify spectator ions in a double-replacement reaction.

    ⟶ **MISCELLANEOUS** *Solutions* "Miscible and Nonmiscible Liquids"

12. Draw energy profiles for catalyzed and uncatalyzed chemical reactions in terms of activation energy.

    ⟶ **LAB** *Kinetics* "Examining a Reaction Mechanism"

13. Write an equilibrium expression and calculate the equilibrium constant based on the concentration of reactants and products at equilibrium.

    ⟶ **LAB** *Equilibria* "Equilibrium and Temperature"

    ⟶ **LAB** *Equilibria* "Equilibrium and Pressure"

14. Interpret the magnitude of the equilibrium constant to determine equilibrium concentrations and direction of a chemical reaction that has yet to reach equilibrium.

→ **Lab** *Equilibria* "Equilibrium and Temperature"

→ **Lab** *Equilibria* "Equilibrium and Pressure"

15. Apply Le Chatelier's Principle to predict shifts in the direction of a chemical reaction in response to changes in temperature, pressure and concentration of reactants or products.

→ **Lab** *Equilibria* "Equilibrium and Temperature"

→ **Lab** *Equilibria* "Equilibrium and Pressure"

16. Calculate the percent ionization and pH of a solution given the identity, concentration, and acid/base dissociation constant of an acid or base.

→ **Lab** *Acids & Bases* "Strong Acids"

19. Characterize the strength of acids and bases by exploring their chemical structures.

→ **Lab** *Acids & Bases* "Structure and Acidity"