Map: **Chemistry** Grade Level: **10**

District: **Island Trees**

Created: **05/07/2007** Last Updated: **05/07/2007**

	Essential Questions	Content	Skills		Standards/PIs	
Unit 1	Why do we need to describe matter? Why is matter divided into its various categories? How does the Law of Conservation of Matter Govern the way proceesses work?	**PHYSICAL BEHAVIOR OF MATTER:** *Units of Measure *Mass vs Weight *Scientific Notation *Significant Figures *Law of Conservation of Matter *Physical vs Chemical Properties & Changes *Compounds vs Mixtures *Homogeneous vs Heterogeneous *Separating Mixtures Matter is composed of individual particles called atoms. Elemental matter is composed of atoms which all have the same properties. Mixtures are made up of two or more substances	Describe physical properties of matter (volume, weight, density) using proper scientific forms and proper scientific equipment Distinguish various forms of matter as elements, pure substances, mixtures and compounds and categorize substances into these classifications. Contrast between physical and chemical changes Compare various methods of separating mixtures and evaluate the effectiveness of the methods		**MST4-K3-3A** **MST4-K3-3B** **MST4-K4-4A** **MST4-K4-4B** **MST4-K3-3D**	

		that can be seperated by physical means. Compounds are made up of two or more substances that may be seperated by chemical means. Compounds have a fixed ratio of components. Elements lose their inherent properties when they form compounds. Compounds are always homogeneous. Mixtures can either be homogeneous (solutions) or heterogeneous. Filteration, distillation and chromatography are some ways to sepaate mixtures. **Vocabulary: Matter, Volume, Mass, Density, Units (metric units), Significant Figure, Element, Compound, Mixture, Heterogenous, Homogenous, Aqueous, Physical Property, Chemical Property, Chemical Change, Physical Change, Distillation, Filtration,**				

Unit 2	How do we describe the relationship between matter and energy? How does temperature affect a gas? How does changing pressure affect gases? How can we use models to describe gas behavior? How did the study of gas behavior lead us to the mole concept?	**PHASES OF MATTER:** *Liquids, Solids, Gases and their Inherent Properties *Melting and Boiling Points *Phase Change Diagram *Vapor Pressure *Phase Equilibrium *Sublimation *The Gas Laws: Boyle's, Charles', Combined Gas Law *the Mole *Properties of Gases *Kinetic Molecular Theory The three phases of matter have different properties. Temperature is a measure of the average kinetic energy of a substance. As substances gain energy their physical form changes and they take on the properties of a different phase.	Create particle models of the different states of matter Apply concepts to phase change diagrams Outline concepts relating gas laws to experimental data Solve problems relating temperature and pressure to volume Generate graphs demonstrating the		**MST4-K3-3B** **MST4-K3-3C** **MST4-K3-3A** **MST4-K3-3D** **MST4-K4-4A** **MST4-K4-4B** **MST4-K5-5B**	

		There are specific temperatures associated with phase changes where energy is being absorbed by the substance. Sublimation occurs where the substance changes directly to a gas from the solid phase, skipping the change to liquid phase. Temperature and pressure changes will greatly effect the volume of gases. Gases can be described in terms of kinetic theory and ideal gas laws where their pressure and volume are related to their energy of motion. At standard temperature and pressure one mole of any gas will occupy 22.4 liters, which is known as the molar volume. **VOCABULARY: Gas, Liquid, Solid, Phase Change, Energy, Freezing, Fusion, Vaporization, Boiling, Sublimation, Vapor Pressure, Joule, STP,** **Volume, Pressure,**	relationship between pressure and temperature for an ideal gas			

		Temperature, Absolute Zero, Kelvin Scale, Celsius Scale, mole, Avogadro's Number, Atomic Mass, Gram Formula Mass, Inverse Proportion, Direct Proportion			
Unit 3	How did our modern concept of the atom develop? How do we describe sub atomic particles? How do we know about sub atomic particles? Where are the electrons located and how do they stay with an atom? How can nuclear reactions benefit us? How does radiation affect us?	**ATOMIC STRUCTURE:** *History of *Sub-atomic particles *Atomic Numbers *Mass Number *Ions *Isotopes *Electron Configuration *Electron-Dot Diagrams *Spectroscropy Many scientists have contributed to the modern theory of atomic structure. Each atom has a positively charged nucleus surrounded by negative electrons. Protons are positively particles located within	Devise a model of the atom using everyday materials. Outline the major historical points in the development of the periodic table. Summarize the parts of the atom and distingush between them. Compare the properties of the subatomic particles and relate their properties to changes that occur during nuclear reactions Distinguish between the types of energy released during nuclear reactions Compare and contrast the benefits of nuclear reactions and their hazards to our environmnet		**MST4-K3-3A** **MST4-K4-4D** **MST4-K5-5C**

		the nucleus, while neutrons are neutral charged. The number of electrons are equal to the protons within an atom, they differ within ions. Electrons are much smaller than the other sub-atomic particles, and are localed in regions called orbitals. Electrons are normally in the ground state, but when they gain energy they jump up to a higher level called the excited state. When they return to the ground state, energy is emitted. This specific emission can identify the element through a spectroscope. The outermost electron level is called the valence shell. This shell contains valence electrons, which are the electrons an atom uses when it undergos reactions. Atoms that have lost or gained elctrons are called ions. They have a charge. Atoms of a specific element will always have the same number of protons. They are called **isotopes** when they differ in the mass number due to different number of neutrons. The average atomic mass is the weighted average of all of its isotopes' masses.	Determine the position and energy of the electrons based on the electron configuration Calculate half life for radioisotopes and determine fraction remaining.				

VOCABULARY: Proton, Neutron, Nucleon, Electron, Nucleus, Orbital, Atomoc Number, Mass Number, Ion, Isotopes,Electron Configuration, Ground State, Excited State, Spectroscopy, Valence Shell, Valence Electrons,Principle Energy Levels,

NUCLEAR CHEMISTRY

*History of

*Types of Radioactivity

*Nuclear Equations

*Transmutations

*Reactors

*Pros and Cons

*Radio-Isotopes

*Half-Lives

Transmutation is when an element's nucleus converts into another elements nucleus. This can occur naturally or by artificial (induced) means.

Natural decay may involve the release of **alpha, beta, positrons**, and/or **gamma** particles. These particles

all have their own unique characteristics.

Nuclear reactions may also include fission and fusion.

There are pros and cons associated with fission and fusion reactions.

Nuclear equations will represent atomic nuclei and emissions involved within the reaction.

Nuclear energy is due to the conversion of mass into energy.

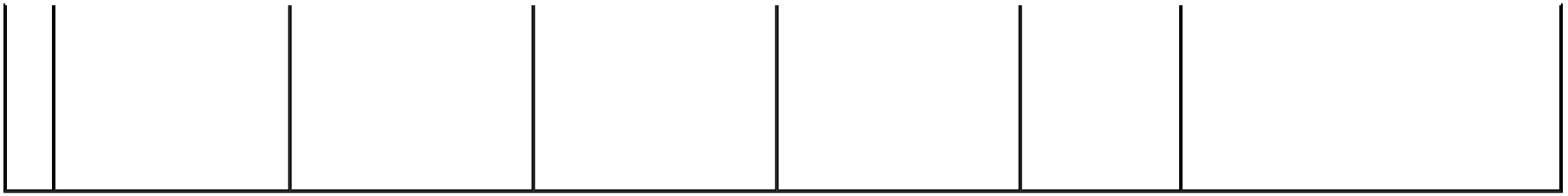
This energy released is greater than that involving chemical reactions.

Radioisotopes have many beneficial uses. These include: radioactive dating, tracers, treatment and detection of diseases.

There are various risks associated with radioactive isotopes. These include: storage of wastes, accidents, bio-damage.

Each radioisotope decays at a specific rate called a **half-life**.

Vocabulary: alpha particle, beta particle, gamma radiation, charge, decay, radioisotope, half life, transmutation, fission, fusion, daughter isotope



	Essential Questions	Content	Skills		Standards/PIs	
Unit 4	Why did scientists devise the periodic table? How do we differentiate between the various groups and periods? Why do metal properties differ so drastically from non-metals? How does increasing atomic number affect the size and reactivity of the atoms? Why do the properties of elements change across a period or down a group? Why do ions form? How does reaching a complete outer-shell influence the way a substance reacts? How do atoms join together to form compounds?	**PERIODIC TABLE:** *History of *The Elements *Metals vs Non-Metals *Specific Groups; Alkali Metals, Transition Metals, Halogens, Noble Gases *Atomic Radius *Ionic Radius *Group and Periodic Trends *Electronegativity *Ionization Energy An element's placement within the **Periodic Table** will determine its physical and chemical properties. The atomic number (number of protons) will identify elements. **Mass Number** (number of protons and neutrons) identifies isotopes. **Elements** can be classified by what group they are in, these elements will have similar properties. Elements within the same group (except for the transition metals) will	Examine the periodic table for features associated with atoms. Contrast an element's atomic number and valence electrons with its position on the periodic table Differentiate between the properties of a metal and a nonmetal Identify the trends in activity of elements based on electron configuration and position in the table. Compose a periodic table of unknown elements based on their knowledge of elemental properties and periodic law.		**MST4-K5-5C** **MST4-K5-5B** **MST4-K5-5C** **MST4-K3-3A** **MST4-K3-3A**	

	How can we determine the difference between ionic substances and covalent substances? How can we determine if the electrons in a bond are being shared equally? Why do molecular substances have different properties than ionic substances? How can we draw a Lewis Dot diagram to show elements joined by electon sharing or electron transfer? Why are there intermolecular forces and how do they affect molecules?	have the same number of valence electrons. There are various trends which appear across the periods and down any specific group. **VOCABULARY: Metals, Non-Metals, Metalloids, Alkali Earth Metals, Alkali, Halogen, Transition Metals, Ductile, Malleable, Luster, Period, Group, Conductivity, Brittle, Diatomic, Noble Gases, Inert, Ions, Electronegativity, Ionization Energy, Covalent Radius, Ionic Radius, Trend, Reactivity** **BONDING:** *Types of Intra-Molecular Forces: Ionic Covalent Metallic *Ionic Character *Inter-Molecular Forces: Dipole-Dipole, Hydrogen Bonding, Dispersion Forces, Molecule-ion Attraction	Distinguish between ionic, molecular and metallic substances from their properties. Describe the nobel gas configuration a specific atom achieves when bonding. Describe the bond between two atoms using differences in electronegativity Demonstrate bonding concepts using Lewis dot structures showing whether electrons are transferred, or shared in a stable octet. Distinguish between nonpolar and polar covalent bonds and use the concept of symmetry to distinguish whether molecules are polar or nonpolar,			

*Lewis Dot Structures

*Formula Writing

Compounds may be divided ino either ionic, covalent or metallic bonding.

Ionic bonds are formed when valence electrons are transferred from one atom to another.

Covalent bonds are formed when electrons are shared between the atoms.

Metallic bonds deal with the electrons being mobile..

Molecular polarity can be determined by the shape and distribution of charge. Non-polar (Symmetrical) molecules would include CO2, while polar (Asymmetrical) molecules include H2O.

Atoms try to reach a stable valence shell configuration. They will react in order to accomplish this. Noble gases have stable valence shells, and tend to not combine.

Physical properties of substances may be explained in terms of their bonds and inter-molecular forces.

Lewis Electron-Dot Diagrams can represent the valence electron arrangement in atoms, ions and substances.

		Electronegativity indicates the attraction that an atom has for electrons. Electronegativity differences determine the degree of polarity or ionic character. Metals tend to react with Non-Metals to form ionic bonds. Non-Metals react with other Non-Metals to form covalent bonds. **VOCABULARY: Ionic Bonds, Covalent Bonds, Metallic Bonds, Ionic Character, Degree of Polarity, Coordinate Covalent, Polar, Non-Polar, Intra-Molecular Attractions, Inter-Molecular Attractions, Hydrogen Bonding, Dipole, Molecule-Ion, Dispersion Forces, Symmetrical, Asymmetrical**				
Unit 5	What is the function of a chemical equation? How can we use equations to determine amounts of substances used or produced by a chemical reaction? How are the Law of Conservation of Mass and Law of Conservation of Matter	**CHEMICAL REACTIONS:** *Parts of an Equation *Types of Reactions *Law of Conservation of Matter *Balancing reactions Chemical reactions can be written in a shorthand form called a chemical equation which combines	Distinguish between different types of chemical reactions Balance chemical reactions in terms of conservation of energy and matter Generate chemical formula from empirical formula and molecular weight		**MST4-K3-3A** **MST4-K3-3B** **MST4-K3-3C** **MST4-K5-5B**	

	related to reactions, especially in relation to balancing?	mathematical symbols with elemental symbols. These equations can be divided into categories based on what is happening with the substances involved. Types of various reactions include: Synthesis, Decomposition, Single Replacement, Double Replacement. Each chemical equation represents the molar amounts of substances and the ratio in which they combine. Matter is balanced on both sides of the equation representing the Law of Conservation of Matter. Chemists use these balanced equations to predict how substances will react and determine amounts of substance expected to combine or be produced by a reaction. **VOCABULARY: Equation, Reactants, Products, Subscript, Yield Sign, Super-Subscript, Coefficient, Law of Conservation,**	Solve chemical equations for products, given the formulas for reactants Calculate gram formula mass Calculate percent composition from mass and from formula Create particle models to demonstrate simple chemical reactions Determine the number of moles of a substance			

Balancing, Single Replacement, Double Replacement, Composition, Decomposition

MATH:

*Gram Formula Mass

*Mole Calculations

*Percent Composition

*Molecular Formula

*Empirical Formula

*Molecular Formula vs Empirical Formula

*Density Problems

*Stoichiometry:

mass/mass

volume/volume

In all equations there is a conservation of mass, energy and charge.

Balanced equations represent a conservation of atoms. Coefficients can be used to determine mole-ratios.

The **formula mass** of a substance is the sum of the masses of its atoms.

The **molar mass** is the mass of one mole of that substance.

		Percent Composition by mass can be calculated mathematically. **Empirical formulas** represent the simplest ratio of the atoms of a compound, and several compounds may share an empirical formula. The **molecular formula** can be determined from the empirical formula and the molar mass by dividing the molar mass by the mass of the empirical formula. **Density of gases** may be determined using the molar volume and formula mass. **Stoichometry** is the math involved in predicting the amounts of substances used or created in a reaction using a balanced chemical equation. **VOCABULARY: Empirical Formula, Molecular Formula, Gram Formula Mass, Moles, Percent Composition, Density**				
	How does dissolving one substance in another affect the properties of	**SOLUTIONS:** *Solutes and	Distinguish between solute and solvent in a system		**MST4-K3-3D** **MST4-K4-4A**	

Unit 6	the substances? Why are various ions and their dissociation so important to electrolytes such as acids and bases? Through which processes can the strength of an acid or base be measured?	Solvents *Types of *Solubility *Expressing Concentrations: Mole Fraction, Parts Per Million Molarity Percent Composition *Colligative Properties A solution is a homogeneous mixture of a solute dissolved within a solvent. Solubility is dependent on various factors like: temperature, pressure, and the nature of the materials. Concentrations of solutions can be expressed in molarity, percent by volume, percent by mass, and parts per million. The addition of a solute to a solvent will cause its boiling point to increase, and its freezing point to decrease. **VOCABULARY: Solute, Solvent, Dissolve, Dilute, Concentrated, Saturated, Unsaturated, Super-Saturated, Electrolyte, Suspension, Colloids, Tyndall Effect, Parts per Million,**	Relate solubility to amount of substance and temperature of solvent Predict the effect a solute has on the solvent in terms of colligative properties Distinguish between soluble and insoluble compounds using reference tables. Describe how solids are dispersed throughout a dissolving medium Distinguish between saturated and unsaturated solutions Construct a chart relating the properties of acids, bases, and salts Summarize the neutralization of an acid with a base by performing a titration. Determine the pH range of a substance using indicators and or pH paper			

Percent by Mass, Percent by Volume, Molarity, Colligative Properties

ACIDS & BASES:

*Electrolytes

*Ionization

*Arrhenius Definitions

*Properties of

*Alternate Acid-Base Theory

*Amphoteric Substances

*Naming of

*Indicators

Litmus Paper

Phenolphtalein

pH

*Neutralization

*Salts

*Hydrolysis

*Ka,Kb,Kw

Arrhenious acids yield hydrogen Ions (H+) which are also known as Hydronium Ions (H2O+).

Arrhenious bases yields Hydroxide ions (OH-).

Acids and bases will react to form salts and water during the process of

		neutralization. Titration is the procedure used to produce neutralization. The Alternate Acid-Base Theory states that an acid is a proton donar, and a base is a proton- acceptor. Acidity and alkalinity can be measured by its pH value. Their relative strengths may be measured by Indicators. Arrhenius Theory can explain the behavior of many acids and bases. Acids and bases are electrolytes which are substances that conduct a current when dissolved. **VOCABULARY: Electrolytes, Acids, Bases, Binary Acids, Ternary Acids, Arrhenious Theory, Arrhenious Acids, Arrhenious Bases, Hydrogen ion, Hydonium Ion, Hydroxide Ion, Dissociation, Ionization, Alternate theory, Amphoteric, Amphiprotic, Ionization Constant, pH, pOH, Water Constant, Solubility Product, Neutralization, Titration, Buret, End Point, Salts, Hydolysis**				

	Essential Questions	Content	Skills		Standards/PIs
Unit 7	How are rates and not quantities essential to any type of equilibrium? How do various factors affect chemical equilibrium? How can the rates of reactions be influenced by various factors?	**KINETICS:** ***Collision Theory** ***Changing Rates of Reactions** ***Activation Energy** ***Catalysts** ***Enthalpy** ***Exothermic Reactions** ***Endothermic Reactions** ***Potential Energy Diagrams** ***Entropy** **Collision Theory predicts that reactions will occur with collisions that have the proper orientation and energy.** **Several factors influence the rate at which reactions occur including: a catalyst, activation energy, temperature, and concentration.** **Potential Energy Diagrams can relate how energy is changed during a chemical reaction.** **Entropy is a measure of disorder, and systems tend to go towards higher entropy in nature.**	Describe the effect temperature, surface area and concentration have on reaction rates using collision theory Interpret potential energy diagrams with and without catalysts. Distinguish between endothermic and exothermic reactions in terms of entropy and enthalpy Construct both exothermic and endothermic potential energy diagrams.		**MST4-K3-3D** **MST4-K4-4A** **MST4-K3-3A**

		VOCABULARY: Enthalpy, Exothermic, Endothermic, Activation Energy, Catalyst, Entropy, Spontaneous **EQUILIBRIUM:** *Types of Equilibrium: Phase Solution Chemical *LeChatelier's Principle *Common-Ion Effect *Haber Process *Contact Process At Equilibrium the rates of the foward and reverse reactions are equal. LeChatelier's Principle can be used to predict any stress or factors upon a system at Equilibrium. **VOCABULARY: Equilibrium, Phase Equilibrium, Solution Equilibrium, Chemical Equilibrium, LeChatelier's Principle, Common-Ion Effect, Haber Process, Contact Process**	Explain how equlibrium is maintained in a saturated solution Relate the entropy of a substance to its phase of matter using KMT Compare and contrast in phase, solution and chemical equilibrium. Predict the effect of stress on an equlibrium using LeChatelier's principle			
	How is the change of oxidation state	**REDOX REACTIONS:**	Use oxidation numbers to determine		**MST4-K3-3B** **MST4-K3-3C**	

Unit 8	related to both oxidation and to reduction reactions? How are electrochemical and electrolytic cells related to oxidation-reduction, and how do they compare?	*Oxidation Numbers *Oxidation *Reduction *Half-Reactions *Oxidizing Agent *Reducing Agent *Table J An oxidation-reduction reaction involves the transfer of electrons. Reduction is the gaining of elections, oxidation the lost. Half-reactions can be written to represent oxidation and reduction. Oxidation numbers can be assigned to atoms and ions. Changes in these will indicate if oxidation or reduction has occurred. **VOCABULARY: Oxidation Number, Valence Number, Oxidation, Reduction, Reducing Agent, Oxidizing Agent, Redox Reactions** **ELECTRO-CHEMISTRY:** *Anodes and Cathodes *ElectroChemical Cells *Salt Bridges *Spontaneous vs Non-	whether an element is losing or gaining electrons Descrtibe oxidation and reduction in terms of electron transfer Determine the missing reactant or product in a balanced equation Balance half reactions for oxidation of free elements and reduction of their monatomic ions. Compare and contrast voltaic and electrolytic cells identify and label parts of the voltaic cell Determine whether or not a reaction will proceed spontaneously using the activity table			

		Spontaneous *Charges *Electrolytic Cells *Electroplating Oxidation occurs within the anode and reduction occurs at the cathode within electrochemical cells. Voltaic cells spontaneously convert chemical energy to electrical. Electrolytic cells convert electric energy into chemical. These are not spontaneous **VOCABULARY: Electro-Chemical Cell, Electrolytic Cell, Voltaic Cell, Voltage, Anode, Cathode, Salt Bridge, Electrolytes, Ions, Spontaneous**	Determine the electron flow in an electrolytic cell and identify where oxidation and reduction are occurring			
Unit 9	Why is carbon's structure and bonding so essential to the variety of compounds within Organic Chemistry? How do Functional Groups impart distinctive properties to various organic compounds?	**ORGANIC** *Properties of Carbon *Structural Formulas *Condensed Formulas *Hydrocarbons *Homologous Series Alkanes, Alkenes Alkynes *Saturated vs Unsaturated *Naming of	Construct various models of compounds using the Molecular-Model Kits Contrast the differences between unsaturated and saturated organic compounds.		**MST4-K3-3B** **MST4-K3-3B** **MST4-K3-3A** **MST4-K5-5B**	

*Prefixes & Endings

*Aromatic Substances

*Functional Groups

*Halides

*Alcohols

*Aldehydes

*Ketones,

*Acids

*Esters

*Ethers

*Amines

*Amides

*Organic Reactions

Organic compounds contain carbon atoms which bond to each other to form a variety of structures.

Hydrocarbons contain only carbon and hydrogen.

Saturated hydrocarbons contain only single-bonds, while unsaturated contain at least one multiple.

Functional Groups include Organic Acids, Alcohols, Aldehydes, Ketones, Halides, Amines, Amides.

Functional goups impart distinctive properties to organic compounds.

Types of organic reactions include: Addition, Substitution, Polymerization,

		Fermentation, Saponification, and Combustion. **VOCABULARY: Tetrahedral, Hydrocarbons, Alkanes, Alkenes, Alkynes, Benzene Series, Saturated,** Unsaturated Functional Groups, Halides, Alcohols, Monohydroxy Alcohol, DiHydroxy Alcohol, Trihydroxy Alcohol, Aldehydes, Ketones, Acids, Esters, Ethers, Amines, Amides, Oxidation, Saponification, Fermentation, Esterfication, Polymerization, Substitution, Addition				

	Essential Questions	Content	Skills		Standards/PIs	
Unit 10		**REVIEW & TESTING**				

Key to Standards used in this Map

MST4-K3-3B [1 occurence] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3B - describe chemical and physical changes, including changes in states of matter. [Elementary]

MST4-K3-3A [1 occurence] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3A - observe and describe properties of materials, such as density, conductivity, and solubility. [Intermediate]

MST4-K3-3B [1 occurence] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3B - distinguish between chemical and physical changes. [Intermediate]

MST4-K3-3C [1 occurence] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3C - develop their own mental models to explain common chemical reactions and changes in states of matter. [Intermediate]

MST4-K3-3A [7 occurences] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3A - explain the properties of materials in terms of the arrangement and properties of the atoms that compose them. [Commencement]

MST4-K3-3B [4 occurences] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3B - use atomic and molecular models to explain common chemical reactions. [Commencement]

MST4-K3-3C [2 occurences] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3C - apply the principle of conservation of mass to chemical reactions. [Commencement]

MST4-K3-3D [4 occurences] - MST Standard 4 - Key Idea 3 [Physical Setting iii] - Performance Indicator 3D - use kinetic molecular theory to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance. [Commencement]

MST4-K4-4A [4 occurences] - MST Standard 4 - Key Idea 4 [Physical Setting iv] - Performance Indicator 4A - observe and describe transmission of various forms of energy. [Commencement]

MST4-K4-4B [2 occurences] - MST Standard 4 - Key Idea 4 [Physical Setting iv] - Performance Indicator 4B - explain heat in terms of kinetic molecular theory.

[Commencement]

MST4-K4-4D [1 occurence] - MST Standard 4 - Key Idea 4 [Physical Setting iv] - Performance Indicator 4D - explain the uses and hazards of radioactivity. [Commencement]

MST4-K5-5B [4 occurences] - MST Standard 4 - Key Idea 5 [Physical Setting v] - Performance Indicator 5B - explain chemical bonding in terms of the motion of electrons. [Commencement]

MST4-K5-5C [3 occurences] - MST Standard 4 - Key Idea 5 [Physical Setting v] - Performance Indicator 5C - compare energy relationships within an atoms nucleus to those outside the nucleus. [Commencement]