Map: **AP CHEMISTRY #1 by JOSEPH M. MANNA** Grade Level: **11** School Year: **2011-2012**

Author: **Joseph Manna** District/Building: **Island Trees / Island Trees High School**

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	Essential Questions	Content	Skills	Assessments	Standards / PIs	Resources / Notes
Unit 1	**How are various mathematical concepts and rules used in the study of matter and energy?** **How can data be used to inform our understanding of chemistry?** **How can measured data be converted between different units?** **What are the various types of ways that can be used to classify chemicals and materials?**	**MATTER & MEASUREMENT:** Classification and properties of matter Uncertainty in measurement Units of Dimensional Analysis Conversion factors **ATOMS, MOLECULES & IONS:** Atomic structure The periodic table Ions and ionic substances Inorganic nomenclature **VOCABULARY:** Matter, properties, chemical change, physical change, matter, atoms, elements, molecules, compounds, mixtures, heterogenious, homogenious, distillation, chromatography, metric system, SI units, density, significant figures, scientific notation,dimensional analysis, conversion factors, nucleus, proton, neutron, electron, atomic number, mass number, atomic weight, periodic table, metals, non-metals, metalloids,diatomic molecules, ion, polyatomic ion, anion, cation, isotopes, oxyanions,binary compounds, ternary compounds **EQUATIONS:** Please see attached file Matter	**Solve problems by using scientific notation format** **Determine accuracy by using the rules of significant figures** **Familiarize the use of dimensional analysis within various calculations** **Convert various data into different units including SI ones** **Calculate problems which have multi-conversion factors** **Distinguish between various physical properties of matter (volume, weight, density) using proper scientific equipment** **Identify the differences between compounds, homogenous and heterogeneous mixtures** **Compare various methods of separating mixtures and evaluate the effectiveness of these methods** **Summarize the sub-atomic particles, and distingush between them** **Distinguish between the metals, non-**		**MST4-K3-3A** **MST4-K4-4A** **MST1-K3-1A** **MST1-K6-2A**	

			metals, and metalloids concerning their properties, reactivities and ability to form ions. Differentiate between ions and atoms concerning sizes, properties and reactivities Categorize materials as to their types of bonding, as well as their inherent physical and chemical properties Relate the nomenclature of the various types of substances			
Unit 2	Why is the composition and balancing of chemical reactions governed by the laws of conservation? How are different properties of materials determined by using various mathematical functions? How can the generation of a stoichiometric equation be used to determine the expected yield of materials produced? How can a stoichiometric equation determine the raw materials needed to react?	**STOICHIOMETRY:** Chemical equations Atomic and molecular mass The mole % composition Formulas Combustion Analysis Reaction stoichiometry Limiting reactants **VOCABULARY:** Reactants,products, equations, coefficent, stoichiometry, combustion reactions, molecular weight, percent composition, Avogadro's number, the mole, molar mass, empirical formula, limiting reactant **EQUATIONS:** Please see attached file	Generate chemical formula from empirical formula and molecular weight Predict the products of chemical equations given the various reactants Convert various units into moles Calculate gram formula mass Calculate percent composition from mass and from formula Determine amounts of products produced in a chemical equation by using the mole ratio		**MST4-K3-3C** **MST1-K3-1A** **MST3-A2.PS.5** **MST3-A2.PS.8** **MST3-A2.PS.9**	

		Stoichiometry	**Calculate the % yield of the products produced** **Determine the limiting reactant, as well as the excess produced within various equations**			
Unit 3	**What are electrolytes and how are they related to solutions?** **How do the various types of chemical reactions differ?** **Why is the titration process the way to determine the concentration of various aqueous solutions, as well as the way to dilute them?**	**CHEMICAL REACTIONS IN AQUEOUS SOLUTIONS:** Electrolytes Precipitation reactions Acids-base reactions Redox reactions Solution concentrations Titrations **VOCABULARY:** Solution, solute, solvent, aqueous, concentrated, dilute, saturated, unsaturated, soluble, insoluble, electrolyte, non-electrolyte, ions, precipitate, precipitation reactions, solubility, strong electrolytes, exchange reactions, spectator ions, net ionic equation,neutralization, acids, bases, salts, titration, redox reactions, oxidation, reduction, oxidation numbers, displacement reaction, activity series, Molarity, molality, parts per million, titration, standard solution, equivalence point, chemical analysis. **EQUATIONS:** Please see attached file Chemical reactions	**Explain what electrolytes are, and how they are produced** **Relate how electrolytes are related to their original solutions, as well as their inherent ions** **Distinguish between different types of chemical reactions** **Express various types of reactions that adhere to the laws of conservation of matter and mass** **Determine the strength or Molarity of a substance as it is related to the number of moles** **Recognize how to use a titration to dilute the Molarity of a substance**	f	**MST4-K3-3B** **MST4-K3-3C** **MST3-A2.PS.5** **MST3-A2.PS.8**	

						http://teachers.sduhsd.net/jnewman/AP%20Chapter%2018%20worksheets/AP%20Equations%20set%205.pdf Equations #5

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Unit 4	**What is the relationship between the first law of thermodynamics and various heat exchanges?** **Which factors have an affect upon how heat is determined?** **How is enthalpy calculated and related to all reactions, including the endothermic and exothermic types?**	**THERMOCHEMISTRY:** Nature of energy First law of thermodynamics q, w, ^E Enthalpy ^H Calorimetry Hess's law Enthalpy of formation ^H, ^Hf **VOCABULARY:** Energy, heat, work, joules, kilojoules, calories, kinetic energy, potential energy, internal energy, endothermic reactions, exothermic reactions, first law of thermodynamics, enthalpy, ^H, enthalpy of reaction, calorimetry, heat capacity, specific heat, ^T, Hess's law, enthalpy of formation, enthalpy of decomposition, **EQUATIONS:** Please see attached file Thermochemistry	**Differentiate between the system and the surroundings as they relate to thermodynamics** **Apply the first law of thermodynamics to various problems concerning heat exchanges** **Calculate heat generated by various factors as they relate to a substance's specific heat, mass, and change in temperature** **Relate ^E to both heat and work** **Distinguish between endothermic and exothermic types of reactions due to their inherent heat content** **Employ a calorimeter to calculate the enthalpy by measuring the net heat flow of a reaction** **The application of Hess's law to reactions by means of their enthalpy changes** **Evaluate the enthalpies of reaction by first using the enthalpies of formation**		**MST4-K4-4A** **MST4-K4-4B** **MST3-A2.PS.2** **MST3-A2.PS.4**	
Unit 5	**How does the position of the electron determine what energies, properties and type of light that gets produced by an atom?** **How can the electron configuration describe the location and the behavior of not only the**	**ELECTRON STRUCTURE:** Energy levels Quantum mechanics Orbitals Electron configurations **VOCABULARY:** Electromagnetic waves, frequency, wavelength, amplitude, crest, speed of light, plank's	**Describe how light can have wave like qualities, and as such can be characterized by wavelength, frequency, amplitude, and speed** **Estimate the element produced by examining its spectral lines by using spectroscopy**		**MST4-K3-3A** **MST4-K4-4A** **MST4-K4-4C** **MST4-K5-5A** **MST4-K5-5C**	

	electron, but of the atom? **Why are quantum numbers used to explain the electron configuration of an atom?** **What are the rules governing the assigning of quantum numbers to an electron's configuration?** **Why is it of such importance that each electron has its own set of quantum numbers?**	constant, quantum, photons, spectra, Bohr model, ground state, excited state, spectroscopy, continuous spectrum, line spectrum, electron shell, Heisenberg uncertainty principle, sub shell, orbital, quantum numbers, spin magnetic quantum number, Pauli exclusion principle, Hund's rule, Aufbau notation, orbital notation, valence electrons, **EQUATIONS:** Please see attached file Electron structure	**Distinguish between the excited and the ground state of an atom by observing the various wavelengths of spectral lines produced** **Determine the position and energy of the electrons based on the electron configuration** **Identify how the quantum numbers are used to explain the location, place, spin, and orientation of each of the electrons that are located within an atom** **Recognize how the Heisenberg uncertainty principle is related to the exact location of the electron within its orbital** **Compose the electron configuration of an atom by adhering to the Aufbau process, Hund's rule, and the Pauli exclusion principle**			
Unit 6	**What are the major historical discoveries which led to the development of the modern periodic table?** **How do ions and atoms differ concerning their radii in relation to the structure of the periodic table?** **How is the location of an element within the periodic table the basis for its physical properties, as**	**PERIODICITY:** Periodic table Atomic radii and ions Ionization energy Oxidation states Metals Non-metals Metalloids VOCABULARY: Atomic radii, Nuclear charges, periodic trends, group trends, ionic radii, isoelectronic series, ionization energy, 2nd ionization	**Describe the major historical points in the development of the periodic table.** **Determine how nuclear charge is related to the placement within a period, and show how this effects the atomic radius of an element** **Analyze the periodic table for features associated with**		**MST4-K3-3A** **MST4-K3-3B** **MST4-K4-4A** **MST4-K5-5C**	

	well as its chemical characteristics?	energy, electron affinity, metallic character, oxidation states, metals, non-metals, metalloids, alkali metals, alkaline earth metals, transition metals, halogens, noble gases, **EQUATIONS:** Please see attached file Periodicity	**atoms and ions** **Relate an element's atomic number and valence electrons with its position on the periodic table** **Predict a periodic table of unknown elements based upon the knowledge of elemental properties** **Identify the trends in activity of elements based on electron configuration and position in the table.** **Determine the various group and period trends inherent within the periodic table, as they relate to atomic radii, electronegativity, ionization energy, metallic character, and electron affinity**			

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Unit 7	**How are electron-dot diagrams and Lewis structures an accurate representation of the different types of bonded substances?** **How do materials relate to each of the different types of bonding?** **How are various properties determined by the type of bonding and the electronegativity differences that a substance has?**	**CHEMICAL BONDING:** Octet rule Ionic bonding Covalent bonding Bond polarity & electronegativity Lewis structures Resonance Exceptions to the octet rule Covalent bond strength **VOCABULARY:** Ionic bonding, covalent bonding, metallic bonding, lattice energy, electron-dot diagrams, lewis structures, non-polar bonding, polar bonding, electronegativity, dipole, symmetrical, asymmetrical, polar molecule, non-polar molecule, octets, valence electrons, formal charge, resonance structures, octet rule, bond enthalpy, bond length, **EQUATIONS:** Please see attached file Chemical bonding	**Draw electron-dot diagrams for atoms and ions, as well as Lewis structures for various ionic and covalent compounds** **Distinguish between the rules for determining the Lewis structures for ionic and covalently bonded substances** **Compare ionic and covalent bonded materials by the properties they show** **Describe the nobel gas configuration a specific atom achieves when bonding.** **Identify how lattice energy can be used to arrange materials as related to their charges and the size of their ions** **Describe the bond between two atoms using differences in electronegativity** **Assess how bond type, bond strength, and bond length are related** **Relate how electronegativity differences determine bond polarity, ionic character, and whether a substance has polar or non-polar bonding** **Recognize the exceptions to the octet rule, as well as the molecules that have resonant structures**		**MST4-K3-3A** **MST4-K5-5A** **MST4-K5-5B** **MST4-K5-5C**	

Unit 8	**How does the molecular structure of a material relate to the bonding/non-bonding electron pairs and polarity of it?** **How are the geometries of a molecule determined, and why is this of such importance?** **What role does orbital overlap and hybridization determine the alignment of bonding, and therefore the properties of their substances?**	**MOLECULAR GEOMETRY:** VSEPR model Molecular polarity Orbital overlap Hybrid orbitals Multiple bonds Diatomic molecules **VOCABULARY:** VSEPR, bond angles, bonding pair, molecular geometry, electron-domain geometry, linear, trigonal ,planer, tetrahedral, trigonal pyramidal, non-bonding electron pairs, octahedral, trigonal bipyramidal, bond dipole, molecular polarity, valence - bond theory, hybid orbitals, hybridization, sp hybrid orbitals, sp2 hybridization, sp3 hybridization, sigma bond, pi bonds, delocalization, molecular orbitals, bond order, electron configuration, paramagnetism, diamagnetism, **EQUATIONS:** Please see attached file Molecular geometry	**Illustrate how symmetry can distinguish whether molecules are polar or nonpolar** **Interpret the various geometries of a molecule by determining the affect its bonding and non-bonding pairs of electrons have upon it** **Relate how the electron-pair repulsion is the basis behind most molecular structures** **Distinguish between the different geometries as predicted by using the VSEPR theory.** **Explain what orbital overlap is, and how it forms sigma and pi bonds** **Describe how hybridization occurs and determine which molecules are formed in this manner**		**MST4-K3-3A** **MST4-K3-3B** **MST4-K5-5A** **MST4-K5-5B** **MST4-K5-5C**	
Unit 9	**How do the gas laws relate the relationship of pressure, temperature and concentration to the behavior of gases?** **Why does the size of a gas particle determine the rate of effusion?** **How does the kinetic-molecular theory of gases predict the properties of both real and ideal gases?**	**GASES:** Pressure Properties of gases Gas laws Ideal gas law Dalton's law of partial pressure Kinetic molecular theory Graham's law of effusion Real gases **VOCABULARY:**	**Solve problems relating temperature, pressure and moles to volume** **Relate how Avogadro's law, the combined gas law , and the the ideal gas law are all inter-connected** **Compute how many times faster a lighter gas is to a heavier one by using Graham's law of effusion**		**MST4-K3-3A** **MST4-K3-3D** **MST4-K4-4A** **MST4-K4-4B** **MST4-K5-5A** **MST4-K5-5C**	

		Torr, atmospheres, pasqual, Boyles Law, Charles Law, Gay-Lussac Law, Avogadro's Law, combined gas law, Ideal Gas Equation, STP, ideal gases, real gases, gas constant, Dalton's Law of Partial Pressures, manometer, mole fractions, kinetic-molecular theory, Graham's Law of Effusion, Van de Waals Equation **EQUATIONS:** Please see attached file Gases	**Calculate the partial pressure of a gas by using mole proportions according to Dalton's law** **Determine how the gas over water affects the overall pressure within a partial pressure problem** **Assemble graphs demonstrating the relationship between pressure and temperature for an ideal gas** **Describe how the Kinetic-molecular theory explains the various factors that are related to gases and the gas laws** **Distinguish between real and ideal gases as they relate to the kinetic-molecular theory**			

	Essential Questions	Content	Skills	Assessments	Standards/PIs	Resources/Notes
Unit 10	**What are the various types of intermolecular forces of attraction, and how are they produced?** **How are the intermolecular forces of attraction related to the properties of a substance?** **How are the states of matter, as well as phase changes illustrated by both a heating/cooling curve and a phase change diagram?**	**INTERMOLECULAR FORCES & LIQUIDS:** Gases, liquids, and solids Intermolecular forces Viscosity & surface tension Phase changes Heating/cooling curves Vapor pressure Phase diagrams **VOCABULARY:** Intermolecular forces, dispersion forces, Van de Waals forces, polarizability, dipole-dipole forces, hydrogen bonding, ion-dipole force, viscosity, surface tension, phase changes, heating curve, cooling curve, heat of fusion, heat of vaporization, heat of sublimation, phase change diagram, triple point, critical point, critical temperature, critical pressure, vapor pressure, liquid crystal	**Recognize the different intermolecular forces of attractions, and how they are created** **Distinguish between ion-dipole, dipole-dipole, hydrogen bonding, and dispersion forces of intermolecular forces of attraction** **Explain how Hydrogen bonding determines the properties of adhesion, surface tension, and viscosity** **Create particle models of the different states of matter** **Synthesize and analyze various phase change diagrams** **Illustrate the melting and boiling points, as well as the phase changes and areas of increasing kinetic energy as they relate to heating and cooling curves** **Determine the critical point, triple point, phase changes, as well as the various states of matter within a phase change diagram** **Interprete a phase change diagram for the prediction of the physical and chemical properties that a material has**		**MST4-K3-3A** **MST4-K3-3D** **MST4-K4-4A** **MST4-K4-4B** **MST4-K5-5A**	

Key to Standards used in this Map

MST1-K3-1A [2 occurences] - MST Standard 1 - Key Idea 3 [Mathematical Analysis iii] - Performance Indicator 1A - apply algebraic and geometric concepts and skills to the solution of problems. [Commencement]

MST1-K6-2A [1 occurence] - MST Standard 1 - Key Idea 6 [Scientific Inquiry iii] - Performance Indicator 2A - use various means of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data. [Commencement]

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 [3 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 [2 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 [6 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 [3 occurences] - MST Standard 4 - Key Idea 4 [Physical Setting iv] - Performance Indicator 4B - explain heat in terms of kinetic molecular theory. [Commencement]

MST4-K4-4C [1 occurence] - MST Standard 4 - Key Idea 4 [Physical Setting iv] - Performance Indicator 4C - explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g., molecules, electrons, and nuclear particles. [Commencement]

MST4-K5-5A [5 occurences] - MST Standard 4 - Key Idea 5 [Physical Setting v] - Performance Indicator 5A - explain and predict different patterns of motion of objects (e.g., linear and angular motion, velocity and acceleration, momentum and inertia). [Commencement]

MST4-K5-5B [2 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 [5 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]

MST3-A2.PS.2 [1 occurence] - MST Standard 3 - Problem Solving Strand - Students will build new mathematical knowledge through problem solving. - Performance Indicator A2.PS.2 - recognize and understand equivalent representations of a problem situation or a mathematical concept [Algebra 2 and Trigonometry]

MST3-A2.PS.4 [1 occurence] - MST Standard 3 - Problem Solving Strand - Students will solve problems that arise in mathematics and in other contexts. - Performance Indicator A2.PS.4 - use multiple representations to represent and explain problem situations (e.g., verbally, numerically, algebraically, graphically) [Algebra 2 and Trigonometry]

MST3-A2.PS.5 [2 occurences] - MST Standard 3 - Problem Solving Strand - Students will apply and adapt a variety of appropriate strategies to solve problems. - Performance Indicator A2.PS.5 - choose an effective approach to solve a problem from a variety of strategies (numeric, graphic, algebraic) [Algebra 2 and Trigonometry]

MST3-A2.PS.8 [2 occurences] - MST Standard 3 - Problem Solving Strand - Students will monitor and reflect on the process of mathematical problem solving. - Performance Indicator A2.PS.8 - determine information required to solve a problem, choose methods for obtaining the information, and define parameters for acceptable solutions [Algebra 2 and Trigonometry]

MST3-A2.PS.9 [1 occurence] - MST Standard 3 - Problem Solving Strand - Students will monitor and reflect on the process of mathematical problem solving. - Performance Indicator A2.PS.9 - interpret solutions within the given constraints of a problem [Algebra 2 and Trigonometry]