Map: **AP CHEMISTRY #2 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 do the various solids differ in terms of type of bonds and their properties?** **How do the different types of lattices differ and how are they related to the unit cell?** **What are the different kinds of polymers, and how are each synthesized?**	**SOLIDS:** Types of solids Metallic solids Ionic solids Molecular solids Network solids Polymers **VOCABULARY:** Metallic solids, network solids, polymers, nanomaterials, ionic solids, molecular solids, crystal lattice, amorphous solids, delocalized electrons, alloys, electron sea model, lattice energy, semi-conductors, conduction band, valence band, monomers, polymerization, plastics, thermoplastic, elastomer, addition polymerization, condensation polymerization, copolymers, **EQUATIONS:** Please see attached file Solids	**Distinguish between ionic, metallic and molecular solids, and relate what is unique about network solids** **Determine the properties of each of the various types of solids, and how these are related to their structure and make up** **Compare crystalline solids to amorphous solids and how their properties are related** **Distinguish between lattice vectors and the unit cell, recognizing the different types of lattices and their locations of lattice points** **Relate how the interconnections between polymers determine the specific properties of the poylmer**		**MST4-K3-3A** **MST4-K3-3B** **MST4-K5-5A** **MST4-K5-5B** **MST4-K5-5C**	

			Distinguish between addition polymerization and condensation polymerization			
Unit 2	**How are factors, such as temperature, concentration, equilibrium, and forces related to the solubility of a solute within a solution?** **What are the various methods for expressing concentration of a substance, and how are these calculated?** **How are colligative properties affected by the concentration and the type of solute?**	**SOLUTION PROPERTIES:** The solution process Factors affecting solubility Expressing concentrations (Molarity, m, ppm) Colligative properties Colloids **VOCABULARY:** Solution, Solute, solvent, colloid, saturated, supersaturated, unsaturated, solubility, hydration, solvation, crystallization, precipitation, soluble, insoluble, miscible, immiscible, Henry's Law, mass percentage, parts per million, Molarity, molality, colligative properties, boiling point elevation, freezing point depression, osmosis, molar mass, colloidal dispersions, tyndall effect, hydrophillic, hydrophobic **EQUATIONS:**	**Distinguish between solute and solvents, solutions and colloids, soluble and insoluble** **Relate solubility to a substance's concentration and temperature** **Express how intermolecular forces determine the solubility of a substance** **Explain the role of equilibrium to the solubility of a solute** **Identify how the factors of pressure and temperature affects the solubility of a gas** **Express solubility in terms of Molarity, molality, parts per million, percent composition, mass percent, and mole fraction** **Predict the effect a solute has on the solvent in terms of colligative properties such as freezing point depression** **Determine the difference in colligative properties as to whether the solute**		**MST4-K3-3D** **MST4-K5-5A** **MST4-K5-5C** **MST1-K6-2A**	

		Please see attached file Solution properties	**is an electrolyte or a non-electrolyte** **Calculate the changes in freezing point and/or boiling point of a substance as related to their molalities** **Describe how solids are dispersed throughout a dissolving medium** **Distinguish between saturated and unsaturated solutions**			
Unit 3	**What are the factors that can affect the rate of a reaction?** **What are the parts that compose a potential energy diagram, and how are these related to exothermic and endothermic reactions?** **How is the rate law related to other factors, such as pressure, volume and temperature?** **How is the rate law determined?**	**KINETICS:** Reaction rates Concentration & rate laws Time & concentration Temperature Collision theory & activation energy Reaction mechanism & rate-determining step Catalysts **VOCABULARY:** Reaction rate, concentration, catalyst, instantaneous rate, rate law, rate constant, reaction order, first-order	**Assess the effect temperature, surface area and concentration have on reaction rates using collision theory** **Identify the potential energy of the reactants, the activation energy, the potential energy of the products, and the enthalpy within a potential energy diagram** **Interpret potential energy diagrams with and without catalysts.** **Distinguish between endothermic and exothermic reactions in terms of entropy and enthalpy**		**MST4-K3-3A** **MST4-K3-3B** **MST4-K3-3C** **MST4-K3-3D** **MST4-K4-4A** **MST4-K4-4B** **MST4-K5-5A** **MST4-K5-5B** **MST4-K5-5C** **MST1-K6-2A**	

		reaction, second-order reaction, third-order reaction, zero-order reaction, half-life, collision theory, collision model, activation energy, activated complex, potential energy of reactants, potential energy of products, arrhenious equation, frequency factor, reaction mechanism, molecularity, unimolecular, bimolecular, termolecular, intermediate, rate-determining step, homogeneous catalyst, heterogeneous catalyst, **EQUATIONS:** Please see attached file Kinetics	**Construct both exothermic and endothermic potential energy diagrams** **Describe the relationship between the rate of formation and the rate of decomposition between the forward and reverse aspects of a reversible reaction** **Describe what the rate law is concerning its reaction order and rate constant.** **Calculate the rate law concerning the various concentrations of the reactants given from a series of experiments** **Prepare the integrated form of the rate law as related to the concentration of a reactant within a chemical equation** **Determine the rate-determining step within a reaction mechanism for various types of reactions**			

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Unit 4	**How does equilibrium relate to the forward and the reverse parts of a reaction?** **How is the equilibrium constant calculated for any type of reaction?** **What affect will various types of stress's have upon the equilibrium of a reaction?**	**CHEMICAL EQUILIBRIUM:** Equilibrium & the equilibrium constant - K Magnitude of K Kp and Kc Calculating & applications of K Le chatelier's principle **VOCABULARY:** Chemical equilibrium, Haber process, law of mass action, equillibrium constant, homogeneous equilibria, heterogeneous equilibria, equilibrium constant, reaction quotient, LeChatelier's Principle, **EQUATIONS:** Please see attached file Equilibrium	**Assess the relationship between the rates of the forward and reverse reactions and the chemical equilibrium** **Describe how equilibrium is maintained in a saturated solution** **Explain how the law of mass action is based upon the relationship between the concentrations of reactants and products within a chemical equation** **Determine the equilibrium constant expression for any chemical reaction** **Relate the ratio of the concentration of the products to the concentration of reactants as they determine the quantity of the equilibrium constant** **Predict which reaction is favored within a reversible reaction by observing the concentrations of both the reactants and products that make them up** **Predict the effect of stress on an**		**MST4-K3-3C** **MST4-K3-3D** **MST4-K5-5B** **MST4-K5-5C** **MST4-K5-5A** **MST1-K3-1A** **MST1-K6-2A**	

			equilibrium using LeChatelier's principle			
Unit 5	**How do the theories of acids and bases differ?** **What are the main points of each of the theories of acids and bases?** **What ways do strong and weak electrolytes differ in terms of their dissociation?** **How are electrolytes related to their conjugates?** **How is the strength of electrolytes determined and how can they be neutralized?**	**ACIDS & BASES:** Types of acids and bases Strength of acids Kw and the auto-ionization of water pH and pOH Weak acids & bases Ka and Kb calculations Acid-base properties of salt solutions **VOCABULARY:** Acids, bases, arrhenious theory, hydrogen ion, hydroxide ion, hydronium ion, Bronsted-Lowry acid, Bronsted-Lowry base, amphiprotic, amphoteric, conjugate acid-base pair, conjugate acid, conjugate base, autoionization, ion-product constant, pH, pOH, pH scale, strong acid, strong base, weak acid, weak base, acid-dissociation constant, percent ionization, polyprotic acids, binary acids, oxyacids, amines, salts, acidic salt, basic salt, cation, anion, carboxylic acids, lewis acid, lewis base,	**Describe the similarities and differences between the three theories of acids and bases. Arrhenius, Bronsted/Lowry theory and Lewis theory of acids and bases** **Compare the properties of acids, bases, and salts** **Summarize how the dissociation and ionization of particles determines the electrolytic properties of acids, bases and salts** **Contrast the strength of an acid to its conjugate base pair** **Relate how the autoionization of water enables it to exhibit amphoteric properties** **Calculate the pH or pOH of a material given its hydrogen or its hydroxide ion concentration** **Determine the Ka or Kb for a weak acid or a weak base** **Describe the neutralization of an acid with**		**MST4-K3-3A** **MST4-K3-3B** **MST1-K3-1A** **MST3-A2.PS.5** **MST3-A2.PS.8**	

		EQUATIONS: Please see attached file Acids and bases	**a base during a titration** **Determine the pH range of a substance using indicators** **Compare the properties and dissociations of acidic salts with basic and neutral ones**			
Unit 6	**How do buffers effect various materials in relation to their pH and other properties?** **How can titration curves be used to determine various types of data such as equivalence points or pH?** **How are precipitates formed and how are they related to the solubility of a substance?**	**AQUEOUS EQUILIBRIA:** Common-ion effect Buffers Titrations Ksp and precipitation Factors that affect solubility **VOCABULARY:** Common-ion effect, buffers, Henderson-Hasselbach equation, buffer capacity, titration, initial ,pH, equivalence point, after equivalence point, solubility product, amphoterism, amphoteric oxides, precipitation, qualitative analysis, quantitative analysis **EQUATIONS:** Please see attached file Aqueous equilibria	**Describe how the common-ion effect works, and how it is related to the equilibrium of the various aqueous substances** **Determine how buffers work, and how they affect changes to the pH** **Calculate the equivalence point within a titration between acids and bases of various strengths** **Analyze the data from different types of titration curves relating strong or weak acids and bases** **Calculate the pH at any point of any type of acid base combination within a titration** **Relate how pH is related to the solubility of various substances**		**MST4-K3-3A** **MST4-K3-3D** **MST1-K6-2A** **MST1-K6-2C**	

			Compute the pH of a buffer within an acid base conjugate pair by using the Henderson-Hasslbalch equation **Determine the formation of a precipitate comparing the ion product to the solubility product constant - Ksp**			

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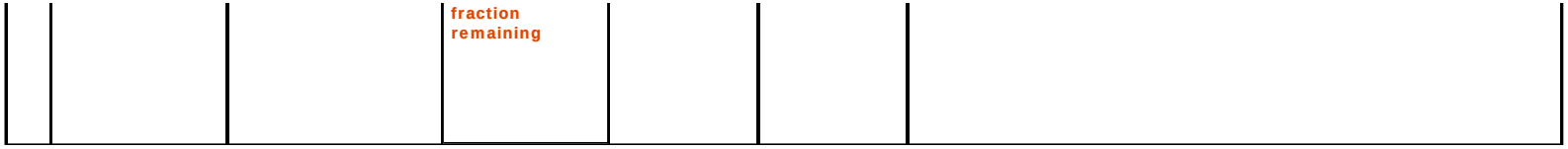
Unit 7	**What is entropy and how is it related to the second law of thermodynamics, as well as the various phases of matter?** **How can the magnitude of entropy or of free energy be calculated?** **How is Gibbs free energy related to various factors , such as temperature, enthalpy, and entropy, as well as to equilibrium, and spontaneity?**	**THERMODYNAMICS:** Spontaneity, Entropy & the 2nd law Molecular interpretation of entropy Calculation of ^S Free energy change Gibbs free energy calculation Relationship between ^G and K **VOCABULARY:** Thermodynamics, spontaneous process, reversible reaction, irreversible reaction, non-spontaneous, entropy, ^S, first law of thermodynamics, second law of thermodynamics, third law of thermodynamics, Boltzmann's equation, translational motion, vibrational motion, rotational motion, standard molal entropies, Gibbs free energy, Gibbs free energy equation, standard free energy of formation **EQUATIONS:** Please see attached file Thermodynamics	**Distinguish between endothermic and exothermic reactions in terms of entropy and enthalpy** **Describe the various ways in which the entropy of a chemical reaction can increase** **Relate how the entropy of the universe is equal to the sum of the entropies of a system and its surroundings according to the second law of thermodynamics** **Identify that both the system and the surroundings can be restored to both their original states by just reversing the process used within a reversible reaction** **Relate the entropy of a substance to its phase of matter using the kinetic molecular theory** **Predict the sign of ^S for various different types of chemical reactions** **Relate how Gibbs free energy is related to enthalpy and entropy, as well**		**MST4-K3-3B** **MST4-K3-3D** **MST4-K5-5B** **MST4-K5-5C** **MST1-K3-1A**	

			as Kelvin temperature **Determine the spontaneity of a chemical reaction by using the Gibbs free energy equation** **Relating Gibbs free energy to the equilibrium constant**			
Unit 8	**How is the change of an oxidation state related to oxidation and to reduction reactions?** **What ways can the types of redox reactions be expressed?** **How can redox reactions be balanced?** **How do the types of cells differ within the area of electrochemistry and how does this relate to their cell potentials?** **How does anodes and cathodes related to oxidation and reduction, as well as to electron flow?** **How do cell potentials relate to equilibrium and to spontaneity?**	**REDOX & ELECTROCHEMISTRY:** Identifying and balancing redox reactions Voltaic cells Standard reduction potentials Spontaneity of redox reactions Nernst equation Batteries Faraday's law & stoichiometry **VOCABULARY:** Oxidation, reduction, oxidizing agent, reducing agent, redox, oxidation numbers, half-reactions, reduction half-reaction, oxidation half-reaction, electrochemistry, voltaic cells, anode, cathode, salt bridge, anions, cations, electrodes, electrolyte, electromotive force, cell potential, standard reduction potentials, free energy, Faraday's constant, Nernst equation, concentration cell, battery, electrolytic cell, electroplating, corrosion, cathode protection **EQUATIONS:** Please see attached file	**Determine whether an element is losing or gaining electrons by using oxidation numbers** **Describe oxidation and reduction in terms of electron transfer** **Calculate the strengths of various oxidation and reducing agents** **Determine the coefficents in a balanced redox equation** **Balance oxidation half reactions, as well as reduction ones for their ions** **Compare and contrast voltaic and electrolytic cells** **Identify and label parts of the voltaic cell, including the**		**MST4-K3-3B** **MST4-K3-3C** **MST4-K4-4A** **MST4-K5-5A** **MST4-K5-5C**	

		Redox & electrochemistry	**salt bridge, anode, cathode, electrolyte** **Calculate the standard cell potentials from standard reduction potentials** **Relate the cell potential to free energy and the equilibrium constant by using Faraday's constant** **Compare the similarities and differences between anodes and cathodes as they deal with the different types of redox reactions** **Determine whether or not a reaction will proceed spontaneously as determined by its overall cell potential** **Determine the electron flow in an electrolytic cell and identify where oxidation and reduction are occurring, as well as where the anode and cathode are**			
Unit 9	**How are the types of transmutations produced?** **How are the types of transmutations different?**	**NUCLEAR CHEMISTRY:** Nuclear stability Transmutation Rates of decay Fission Fusion	**Predict nuclear stability by examining the neutron to proton ratio of the nucleus of an isotope** **Relate the differences between natural**		**MST4-K3-3A** **MST4-K4-4A** **MST4-K4-4D** **MST4-K4-4C** **MST4-K5-5C**	

What are the benefits and the drawbacks associated with nuclear reactions including the use of reactors? **How do fission and fusion work and compare to each other?** **How are half lives related between the types of radioisotopes?** **How can half lives be calculated?**	Uses and affects of radiation **VOCABULARY:** Radioisotopes, alpha particles, beta particles, gamma radiation, nucleons, alpha decay, beta decay, transmutation, artificial transmutation, positrons, neutron-to-proton ratio, nuclear stability, transuranium elements, half-life, radioactive decay, mass defect, nuclear binding energy, fission, fusion, critical mass, chain reaction, nuclear waste, ionizing radiation, radiation, rem **EQUATIONS:** Please see attached file Nuclear	**transmutation with artificial transmutation** **Compose balanced nuclear equations in relation to alpha decay, beta decay and gamma decay** **Distinguish between the types of energy released during nuclear reactions** **Describe the way that a nuclear reactor works, including the role of the control rods, fissionable material, moderator, containment vessel, water towers** **Compare and contrast the benefits of nuclear reactions and their hazards to our environment** **Determine the position and energy of the electrons based on the electron configuration** **Distinguish between fission and fusion as related to their energy output, radioactivity, safety, materials used, as well as the way in which both occur** **Calculate half life for radioisotopes and determine**		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remaining

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Unit 10	**What are the various classifications that organic materials are seperated into and how do they compare to one another?** **How are isomers, chiral substances, enantiomers and stereoisomers different from the standard compositions and structures of substances?** **What are the major materials and reactions that are related to biochemistry?**	**ORGANIC:** Hydrocarbons Alkanes, alkenes, and alkynes Aromatic materials Structural isomers Naming of hydrocarbons Substitution and addition reactions Functional groups Chirality Biochemistry **VOCABULARY:** Organic chemistry, biochemistry, hydrocarbon, alkanes, alkenes, alkynes, aromatic hydrocarbons, saturated hydrocarbons, unsaturated hydrocarbons, functional groups, structural isomers, cycloalkanes, geometric isomers, combustion, addition reaction, substitution reaction, alcohols, esters, ethers, aldehydes, organic acids, amines,amides, ketones, fermentation, saponification, esterfication, hydrolysis, amino acids, proteins, carbohydrates, lipids, polypeptides, peptides,	**Compare the differences between alkanes, alkenes, and alkynes** **Construct various models of compounds using the Molecular-Model Kits** **Contrast the differences between unsaturated and saturated organic compounds** **Distinguish between substitution and addition reactions as they relate to saturated and unsaturated hydrocarbons** **Differentiate between the various organic functional groups, including: alcohols, aldehydes, acids, ketones, esters, ethers, amines, and amides** **Identify the specific functional group- whether it be by structural formula, condensed formula, empirical formula, or by its nomenclature**		**MST4-K3-3A** **MST4-K3-3B** **MST4-K5-5B** **MST1-K6-2A**	

		nucleic acids, DNA, RNA, double helix	**Determine the different characteristics inherent in each of the various organic functional groups** **Compare geometric isomers with structural ones** **Determine what chiral materials are, and how they are related to enantiomers** **Identify the various types of organic reactions such as: esterfication, fermentation, saponification, combustion and polymerization** **Recognize the amino acids and relate how their connections can lead to the polymers of proteins** **Distinguish between proteins, carbohydrates and lipids**			

Key to Standards used in this Map

MST1-K3-1A [3 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 [5 occurences] - 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]

MST1-K6-2C [1 occurence] - MST Standard 1 - Key Idea 6 [Scientific Inquiry iii] - Performance Indicator 2C - assess correspondence between the predicted result contained in the hypothesis and the actual result and reach a conclusion as to whether or not the explanation on which the prediction was based is supported. [Commencement]

MST4-K3-3A [6 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 [6 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 [3 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 [5 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 [3 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 [1 occurence] - 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-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-K5-5A [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 [5 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 [7 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.5 [1 occurence] - 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 [1 occurence] - 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]