Chemistry, 4th 4.5 weeks
2017-18

Big Ideas/Key Concepts:

- Understandings about scientific inquiry and the ability to conduct inquiry that are essential for living in the 21st century
- Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies
- Science applies mathematics to investigate questions, solve problems, and communicate findings

Embedded Inquiry

- **SPI 3221.Inq.1 - 7 (See 1st Quarter)**

Embedded Technology & Engineering

- **SPI 3221.T/E.1** Distinguish among tools and procedures best suited to conduct a specified scientific inquiry
- **SPI 3221. T/E .2** Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.
- **SPI 3221. T/E .3** Evaluate the overall benefit to cost to ratio of a new technology
- **SPI 3221. T/E .4** Use design principles to determine if a new technology will improve the quality of life for an intended audience

Embedded Mathematics *(Checks for Understanding)*

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

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- *9* **3221.Math.9** Select appropriate units, scales, and measurement tools for problem situations involving proportional reasoning and dimensional analysis.
- *9* **3221.Math.10** Select, construct, and analyze appropriate graphical representations for a data set.
- *9* **3221.Math.11** Identify and solve different types of stoichiometry problems (e.g., volume at STP to mass, moles to mass, molarity).
- *9* **3221.Math.12** Calculate the amount of product expected in an experiment and determine percent yield.
- *9* **3221.Math.13** Convert among the quantities of a substance: mass, number of moles, number of particles, molar volume at STP.

TN Academic Standards	Student Friendly "I Can" Statements	Prerequisite Knowledge	ACT Readiness	Instructional Time	TN Ready Questions/Resources	ACT Questions/Resources
SPI 3221.2.2 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, percent composition, factors that affect the rate of solution.	I can create and analyze solutions to identify solutes and solvents, quantitatively analyzing concentrations. I can model the process by which solutes dissolve in solvents, and predict how intermolecular forces affect solubility. I can solve problems involving molarity, molality, percent composition, ppm, and ppb.	*9* **3221.Math.1** Use a variety of appropriate notations (e.g., exponential, functional, square root). *9* **3221.Math.2** Select and apply appropriate methods for computing with real numbers and evaluate the reasonableness of the results. *9* **3221.Math.3** Apply algebraic properties, formulas, and	IOD03	5 Days		

	I can determine colligative properties of a solution based on the molality and freezing point or boiling points of the solvent.	relationships to perform operations on real-world problems (e.g., solve for density, determine the concentration of a solution in a variety of units: ppm, ppb, molarity, molality, and percent composition) calculate heats of reactions and phase changes, and manipulate gas law equations. *9* **3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties,				

		nuclear decay or half-life). *9* **3221.Math.5** Analyze graphs to describe the behavior of functions (e.g., concentration of a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life). *9* **3221.Math.6** Model real-world phenomena using functions and graphs. *9* **3221.Math.7** Apply and interpret algebraic properties in symbolic manipulation (e.g., density, concentration of a solution,				

		chemical equations, effect of volume, temperature or pressure on behavior of a gas, percent composition of elements in a compound, molar mass, number of moles, and molar volume, amount of products or reactants given mole, molarity, volume at STP or mass amounts, heat loss or gain using mass, temperature change and specific heat, and half-life of an isotope). *9* **3221.Math.8** Apply and communicate measurement units, concepts				

		and relationships in algebraic problem-solving situations. *9* **3221.Math.10** Select, construct, and analyze appropriate graphical representations for a data set.				
SPI 3221.2.3 Classify a solution as saturated, unsaturated, or supersaturated based on its composition and temperature and a solubility graph.	I can use the composition and temperature of a solution, and read a solubility graph to determine if a solution is saturated, unsaturated, or supersaturated.	*9* **3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties, nuclear decay or half-life). *9* **3221.Math.5** Analyze graphs to describe the behavior of functions (e.g., concentration of	IOD01, EMI03	1 Day		

		a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life). *9* **3221.Math.6** Model real-world phenomena using functions and graphs. *9* **3221.Math.10** Select, construct, and analyze appropriate graphical representations for a data set.				
SPI 3221.2.5 Compare and contrast heat and temperature changes (endothermic / exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes.	I can determine heat and temperature changes in chemical and physical processes. I can model energy transfer during an endothermic and exothermic chemical	*9* **3221.Math.1** Use a variety of appropriate notations (e.g., exponential, functional, square root). *9* **3221.Math.2** Select and apply appropriate	IOD03	1 Day		

	reaction.	methods for computing with real numbers and evaluate the reasonableness of the results. *9* **3221.Math.3** Apply algebraic properties, formulas, and relationships to perform operations on real-world problems (e.g., solve for density, determine the concentration of a solution in a variety of units: ppm, ppb, molarity, molality, and percent composition) calculate heats of reactions and phase changes, and manipulate gas law equations.				

		9 **3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties, nuclear decay or half-life). *9* **3221.Math.5** Analyze graphs to describe the behavior of functions (e.g., concentration of a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life). *9* **3221.Math.6** Model real-world phenomena using functions and graphs.				

		9 **3221.Math.7** Apply and interpret algebraic properties in symbolic manipulation (e.g., density, concentration of a solution, chemical equations, effect of volume, temperature or pressure on behavior of a gas, percent composition of elements in a compound, molar mass, number of moles, and molar volume, amount of products or reactants given mole, molarity, volume at STP or mass amounts, heat loss or gain using mass,				

		temperature change and specific heat, and half-life of an isotope). *9* **3221.Math.8** Apply and communicate measurement units, concepts and relationships in algebraic problem-solving situations. *9* **3221.Math.10** Select, construct, and analyze appropriate graphical representations for a data set.				
SPI 3221.2.6 Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.	I can explain how intermolecular forces contribute to states of matter at room temperature. I can compare and contrast the processes	*9* **3221.Math.3** Apply algebraic properties, formulas, and relationships to perform operations on real-world	EMI04, IOD01	1 Day		

	of freezing, melting, boiling, condensation, sublimation, and deposition. I can interpret a phase diagram.	problems (e.g., solve for density, determine the concentration of a solution in a variety of units: ppm, ppb, molarity, molality, and percent composition) calculate heats of reactions and phase changes, and manipulate gas law equations. *9* **3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties, nuclear decay or half-life). *9* **3221.Math.5** Analyze graphs				

		to describe the behavior of functions (e.g., concentration of a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life). *9* **3221.Math.6** Model real-world phenomena using functions and graphs. *9* **3221.Math.7** Apply and interpret algebraic properties in symbolic manipulation (e.g., density, concentration of a solution, chemical equations, effect of volume, temperature or				

		pressure on behavior of a gas, percent composition of elements in a compound, molar mass, number of moles, and molar volume, amount of products or reactants given mole, molarity, volume at STP or mass amounts, heat loss or gain using mass, temperature change and specific heat, and half-life of an isotope).				
SPI 3221.3.8 Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.	I can write the nuclear equation involving alpha or beta particles based on the mass number of the parent isotope and complete symbols for alpha or beta emissions.	*9* **3221.Math.2** Select and apply appropriate methods for computing with real numbers and evaluate the reasonableness		1 Day		

	I can compare alpha, beta, and gamma radiation.	of the results. ***9* 3221.Math.4** Interpret rates of change from graphical and numerical data (e.g., phase diagrams, solubility graphs, colligative properties, nuclear decay or half-life). *9* **3221.Math.5** Analyze graphs to describe the behavior of functions (e.g., concentration of a solution, phase diagrams, solubility graphs, colligative properties, nuclear decay half-life) numerical data (e.g., phase diagrams, solubility graphs, colligative				

		properties, nuclear decay or half-life). ***9* 3221.Math.7** Apply and interpret algebraic properties in symbolic manipulation (e.g., density, concentration of a solution, chemical equations, effect of volume, temperature or pressure on behavior of a gas, percent composition of elements in a compound, molar mass, number of moles, and molar volume, amount of products or reactants given mole, molarity, volume at STP or				

		mass amounts, heat loss or gain using mass, temperature change and specific heat, and half-life of an isotope).				