Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Structure & Origin of Matter					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:
Range	I.1 Recognize the origin and distribution of elements in the universe.	Identifies that elements all formed in stars.	Recognizes that all matter in the universe is composed of the same elements.	Identifies the distribution of elements. Compares the occurance of heavier elements on Earth and in the universe.	Makes connections of the distribution of elements in relation to real world uses of elements.
Range	I.2 Relate the structure, behavior, and scale of an atom to the particles that compose it.	Identifies protons, neutrons, and electrons as parts of the atom. Identifies the protons of an element. Recognizes that the current model of the atom is based on historical evidence.	Matches the charge and position of protons, neutrons, and electrons. Given texts that describe a discovery, makes connection to how the model of the atom has changed. Sates that there is a fixed number of atoms in a mole.	Compares the relative sizes of protons, neutrons, and electrons. Explains the relationship between proton number and an element's identity. When given text, evaluates the limitiation of atomic models. Relates the mass and the number of atoms to gram-sized quantities of matter in a mole.	Explains why atomic models are limited and gives specific evidence. Determines mass, number of atoms, or number of moles in a sample.
Range	I.3 Correlate atomic structure and the physical and chemical properties of an element to the position of the element on the periodic table.	Identifies the number of protons in atoms of an element using the periodic table. Recognizes that position on the periodic table is based on properties of the elements.	Identifies the number of electrons in neutral atoms of an element using the periodic table. Recognizes that different isotopes have different masses. Explains that an element's properties determine its position on the period table.	Determines the number of neutrons in a given isotope. Compares the protons and neutrons of different isotopes of the same element. Explains that properties of elements are similar going down groups and properties of elements change across periods. Generalizes the trends of reactivity within a group.	Determines the number of neutrons in atoms using the periodic table. Makes the connection between the masses of isotopes and average atomic mass on the periodic table. Compares and contrasts the properties exhibited by elements within groups of the periodic table. Generalizes the trends of reactivity between groups.
Atoms & Energy					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:

DRAFT

Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Range	II.1 Evaluate quantum energy changes in the atom in terms of the energy contained in light emissions.	Recognizes that light is energy. Recognizes that different elements have different emission spectra.	Recognizes that there is a relationship between wavelength and energy of electromagnetic waves. Recognizes that the light being given off in an emission spectrum is energy. Recognizes that different colors have different energies.	Given a graph, describes the relationship between wavelength and energy. Given experimental evidence, identifies an unknown element when from its emission spectrum. Ranks colors of light based on energy. Indicates if energy is being absorbed or released by electrons from emission/absorption spectra evidence.	Calculates and describes the wavelength, energy, or frequency of a wave. Explains the connection between electron movement and the energy of the associated photons.
Range	II.2 Evaluate how changes in the nucleus of an atom result in emission of radioactivity.	Recognizes that radioactive elements give off radiation. Identifies that different types of radiation are classified by energy. Recognizes that a large amount of energy is given off in a nuclear reaction. Recognizes that nuclear radiation affects organisms.	Recognizes alpha, beta, and gamma radiation as forms of radioactive decay. Identifies the mass, energy, and pentrating power of alpha, beta, and gamma radiation. Recognizes that there is difference in the amount of energy being given off between a nuclear reaction and a chemical reaction. Recognizes that overexposure to nuclear radiation is harmful to organisms.	Recognizes and explains that radioactive particles and electromagnetic radiation are products of the decay of an unstable nucleus. Compares the mass, energy, and pentrating power of alpha, beta, and gamma radiation. Compares the amount of energy released in a nuclear reaction vs a chemical reaction. Given text, identifies the effects of nuclear radiation on organisms.	Predicts the products of the decay of an unstable nucleus. Determines the type of radiation from data about penetration power. Compares the dangers of the three types of radiation to organisms. Compares the strong nuclear force to the amount of energy released in nuclear reactions. Given text, evaluates the effects of nuclear radiation on organisms.
Chemical Bonds					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:

DRAFT

Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Range	III.1 Analyze the relationship between the valence (outermost) electrons of an atom and the type of bond formed between atoms.	Identifies that ions have an electrical charge. Identifies the three types of chemical bonds. Recognizes that electrons are involved in bonds.	Defines valence electron. Recognizess that charges on ions come from gaining and losing electrons. Identifies the type of chemical bond based on the behavior of valence electrons. Recognizes that different types of bonds have different strengths.	Determines the number of valence electrons from the periodic table. Predicts the charge of an atom when it forms an ion. Predicts the type of bond based on the behavior of valence electrons. Compares the different bond strengths relative to type of bond.	Based on the number of valence electrons, predicts reactiivty. Understands why the group has a specific charge.
Range	III.2 Explain that the properties of a compound may be different from those of the elements or compounds from which it is formed.	Recognizes that chemical formulas are made of chemical symbols. Recognizes that different compounds have different physical and chemical properties.	Given a chemical formula, determines the number of atoms of each element represented. Recognizes that compounds made of elements in differing proportions have different physical and chemical poperties change.	Explains that each chemical formula is unique to a specific compound. Compares the physical and chemical properties of a compound to the elements that form it.	Writes the chemical formulas of unfamiliar compounds. Infers real-world uses of chemical compounds based on the proportions of elements.
Range	III.3 Relate the properties of simple compounds to the type of bonding, shape of molecules, and intermolecular forces.	Recognizes that different types of bonds have different types of physical properties. Recognizes that molecules are polar or nonpolar. Recognizes that water has unique properties.	Matches the physical properties to the type of bond. Recognizes that bond shape affects polarity. Recognizes there is a connection between water's unique properties and hydrogen bonding.	Given data, determines the physical properties of the different bond types. Given a model, describes the shape and polarity of water, ammonia, and methane molecules. Identifies how hydrogen bonding affects water's properties.	Identifies the type of bond of unknown compounds based on experimental data. Infers the shape and polarity of similar molecules. Explains why water has its unique properties.
Chemical Reactions					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:

DRAFT

Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Range	IV.1 Identify evidence of chemical reactions and demonstrate how chemical equations are used to describe them.	Recognizes that a visual change can indicate a chemical reaction. Recognizes that a chemical reaction can be represented by a chemical equation. Recognizes that chemical reactions occur everyday.	Recognizes that the release of heat and light are evidence of a chemical reaction. Recognizes that reactants and products to not have the same properties. Given a reaction, identifies the reactants and products of a reaction. Recognizes that the number of atoms in a chemical reaction do not change. Recognizes that coefficients indicate molar proportions. Distinguishes chemical reactions from examples of physical change.	Describes all evidences of chemical reactions. Explains why the properties products are independent of the properties of reactants. Given a reaction, writes a balanced chemical equation. Determines molar proportions from a balanced chemical equation. Gives examples of chemical reactions in everyday life.	Uses evidences of chemical reactions to predict products. Given the reactants of a chemical reaction, predicts the products and balances the equation. Uses molar proportions to predict the amount of products.
Range	IV.2 Analyze evidence for the laws of conservation of mass and conservation of energy in chemical reactions.	Recognizes that reaction can produce heat. States that batteries produce electricity through chemical reactions.	Recognizes that mass cannot be created nor destroyed during a chemical reaction. Recognizes that the amount of product is determine by the amount of reactant. Defines exothermic and endothermic reactions. Recognizes that chemical reactions can absorb or produce energy.	Interprets evidence supporting conservation of mass in reactions. Uses molar relationships from a balanced reaction to predict mass of product. Analyzes evidence of energy transformation and classifies it as endothermic or exothermic. Desribes how electrical energy is produced by an electrochemical cell.	Shows mathematically the conservation of mass in a chemical reaction. Determines which reactant is the limiting factor in a chemical reaction. Classifies everyday reactions as endothermic or exothermic. Explains why reversing a chemical reaction reverses the energy flow.
Equilibrium					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:

DRAFT

Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Range	V.1 Evaluate factors specific to collisions (e.g., temperature, particle size, concentration, and catalysts) that affect the rate of chemical reaction.	Identifies factors that speed up or slow down reactions. Explains that collisions between particles must occur in order for reactions to happen. Recalls that some chemicals increase reaction rates.	Follows a procedure to conduct an experiment comparing reaction rates. Identifies a trend in reaction rate from a graph. Correlates frequency of collisions to reaction rates. Identifies that catalysts are effective in increasing reaction rates.	Conducts an experiment to determine factors affecting reaction rate. Interprets graphs to draw conclusions about reaction rates. Correlates frequency and energy of collisions to reaction rates. Describes how catalysts increase reaction rates.	Designs and conducts an experiment to determine factors affecting reaction rate. Makes inferences about unknown reactions based on similarities to known reactions. Uses information from graphs to draw conclusions about reaction rates and uses the findings to generalize the results to other reactions. Creates energy diagrams showing how catalysts affect reaction rate.
Range	V.2 Recognize that certain reactions do not convert all reactants to products, but achieve a state of dynamic equilibrium that can be changed.	Recognizes that not all reactions go to completion. Observes that equilibrium will change in different conditions.	Recognizes that at equilibrium, amounts of reactants and products do not change. Given an equation, identifies the effect of adding either a product or reactant to a shift in equalibrium. Indicates that temperature changes equilibrium.	Explains the concept of dynamic equalibrium, showing that the rates of forward and reverse reactions are equal and that the reaction has not stopped. Given an equation, predicts how to shift equilibrium towards the product or reactant. Indicates the effect of a temperature change on the equilibrium, using an equation showing a heat term.	Explains the concept of dynamic equalibrium, showing that the rates of forward and reverse reactions are equal, but the amounts of reactants and products are not usually equal. Describes uses of equilibrium in industry. Designs a method to shift equilibrium by altering reaction variables.
Solutions					
		The Level 1 Student:	The Level 2 Student:	The Level 3 Student:	The Level 4 Student:

DRAFT

Chemistry

PLD Type	Objective	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy		The Level 1 student is below proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade level content and engages with higher order thinking skills with extensive	The Level 2 student is approaching proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards**.** The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content and engages in higher order thinking skills with some independence and	The Level 3 student is proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying the English language arts/literacy, mathematics, and science knowledge/skills as specified in the Utah Core State Standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher order thinking skills independently.
Range	VI.1 Describe factors affecting the process of dissolving and evaluate the effects that changes in concentration have on solutions.	Identifies common chemical solutions. Describes the relative amount of solute particles in concentrated and dilute solutions. Identifies factors that affect the rate of dissolution.	Identifies the solute and solvent in solutions given a description or model. Identifies examples of solutions and non-solutions from sketches. Given the molarity of different solutions, states which is more concentrated or more dilute. Follows a procedure to conduct an experiment to compare rates of dissolution. Connects the concept of ppm to environmental issues.	Describes the action of dissolution at the molecular level. Sketches a solution, showing even distribution, at the particle level. Expresses concentration in terms of molarity and molality. Conducts an experiment to determine factors affecting rate of dissolution. Draws conclusions, from graphs of ppm, about environmental issues.	Sketches a solution, showing direction of forces, relative numbers of solvent and solute particles, and seperation of ions, at the particle level. Distguishes between molarity and molality and calculates those quantities. Designs and conducts an experiment to determine factors affecting rate of dissolution.
Range	VI.2 Summarize the quantitative and qualitative effects of colligative properties on a solution when a solute is added.	Recognizes what boiling and freezing points are. Recognizes that solutes have practical applications.	Recognizes that different concentrations of solutions have different boiling and freezing points. Determines the boiling or freezing point of a solution given a graph of concentration vs. temperature. Identifies an example of solutes being used in everyday applications.	Recognizes that boiling point increases and freezing point decreases as concentration increases. Measures change in boiling and/or freezing point of a solvent when a solute is added. Describes how colligative properties affect the behavior of solutions in everyday applications.	Designs an experiment to collect and analyze data and makes inferrences about freezing or boiling point of different solutes in the same concentrations. Extrapolate examples of colligative properties to unfamiliar situations.
Range	VI.3 Differentiate between acids and bases in terms of hydrogen ion concentration.	Recognizes that the pH scale includes acids, bases, and neutral solutions. Recognizes that acids and bases neutralize each other. Recognizes that acids and bases are used in industry.	Using a common indicator, classifies a solution as an acid or base. Identifies neutralization using simple acid-base titration. Recognizes that acids and bases are used differently in different industries. Recognizes that acids and bases affect the environment.	Relates hydrogen ion concentration to pH values and to the terms acidic, basic, or neutral. Using an indicator, measures the pH of common household substances. Determines the relative acidity or basicity of solutions using simple acid-base titration. Reports on the uses of acids and bases in industry, citing evidence. Identifies ways that acids and bases affect the environment.	Recognizes the logrithmic nature of the pH scale. Determines the concentration of an acid or a base using simple acid-base titration. Describes situations and makes inferrences about the uses of acids or bases in industry. Evaluates mechanisms by which pollutants modify the pH of environments.

DRAFT