Chemistry HS

Indicators	Standards	Instructional Examples/ Additional Specificity	Month
actively engages in asking and evaluating research questions.	KS.1.1.1	Well-formed research questions drive scientific inquiry.	throughout year
▲ actively engages in investigations, including developing questions, gathering and analyzing data, and designing and conducting research	**KS.1.1.2**	The scientific investigations includes, when appropriate, a. formulating a testable hypothesis. b. identify and test variables (independent, dependent, and variables to be kept constant). c. using methods for gathering data that is observable, measurable, and replicable. d. analyzing and evaluating the results in order to clarify the questions and hypotheses, and to refine methods for further research.	throughout year
▲ actively engages in using technological tools and mathematics in their own scientific investigations.	**KS.1.1.3**	a. using a variety of technologies, such as hand tools, measuring instruments, calculators, and computers as an integral component of scientific investigations. b. using common mathematical functions to analyze and describe data. c. uses statistical and graphing data analysis techniques. d. recognizes that the accuracy and precision of the data, and therefore the quality of the investigation, depends on the instruments used. e. using equipment properly and safely.	throughout year
actively engages in conducting an inquiry, formulating and revising his or her scientific explanations and models (physical, conceptual, or mathematical) using logic and evidence, and recognizing that potential alternative explanations and models should be considered	KS.1.1.4	a. engages in discussions that result in the revision of his/her explanation. b. analyzes their explanation by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanations and models have the greatest explanatory power. c. evaluates personal preconceptions and biases with respect to his/her conclusions. d. based on their results, students consider modifications to their investigations.	throughout year
actively engages in communicating and defending the design, results, and conclusion of his/her investigation	KS.1.1.5	a. writes procedures, expresses concepts, reviews information, summarizes data, and uses language appropriately. b. develops diagrams and charts to summarize and analyze data. c. presents information clearly and logically, both orally and in writing. d. constructs reasoned arguments. e. responds appropriately to critical comments.	throughout year

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▲understands atoms, the fundamental organizational unit of matter, are composed of subatomic particles. Chemists are primarily interested in the protons, electrons, and neutrons found in the atom.	**KS2A.1.1**	a. All atoms are identified by the number of protons in the nucleus, i.e. the atomic number. The protons have a positive charge and a mass of 1 amu. Protons and neutrons are found in the small, dense, nucleus. b. Neutrons have a neutral charge and a mass of 1 amu. c. The electrons have a negative charge and are found outside the nucleus in an electron cloud. The mass of an electron is approximately 2,000 times smaller than a proton. The electrons determine the size and chemical properties of the atom. a. The number of electrons is equal to the number of protons in a neutral atom. Ions have a different number of electrons than protons.	August September
understands isotopes are atoms with the same atomic number (same number of protons) but different numbers of neutrons. The nuclei of some atoms are radioactive isotopes that spontaneously decay, releasing radioactive energy.	KS2A.1.2	a. The periodic table reflects the average mass of the isotopes. b. Examples of released radioactivity are alpha, beta, and gamma radiation. c. Some isotopes spontaneously decay at a first order rate. There is a negative linear relationship between the log of the sample isotope concentration vs. time, d. To balance a nuclear equation, the sum of the atomic numbers and the sum of the mass numbers must be equal on both sides of the equation.	August September
▲understands chemists use kinetic and potential energy to explain the physical and chemical properties of matter on earth that may exist in any of these three states: solids, liquids, and gases.	**KS2A.2.1**	a. Elements and molecules may exist as gases, liquids or solids. Ionic compounds most commonly exist as solids. b. Intermolecular attraction (attraction between molecules) determines the state of the molecule. Examples of intermolecular attraction include hydrogen bonding, permanent dipole interaction, and induced dipole interaction. Gases have the weakest and solids have the greatest intermolecular attraction. The hydrogen bond is an intermolecular attraction responsible for the properties of water and many biological molecules.	October
▲understands the periodic table lists elements according to increasing atomic number.	**KS2A.2.2**	a. Elements in the same group have the same number of valence electrons and can be used to predict similar physical and	August September

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This table organizes physical and chemical trends by groups, periods, and sub-categories		chemical properties. Elements are grouped by similar ground state valence electron configurations. b. As periods increase, the principle energy levels of the outermost (*valence*) electrons increase. Electrons changing from one energy level to another may result in the emission or absorption of various forms of electromagnetic radiation, including the range of colors that form visible light. When there is color, there are electrons changing energy levels. c. Sub-categories are regions such as metals, non-metals, and transition elements Nonmetals have different physical and chemical properties than metals. For example, nonmetals have lower melting points, lower density, and are poorer conductors of electricity and heat. Chemical properties depend on the subshell of the valence electrons which are different for metals and non-metals.	
▲understands chemical bonds result when valence electrons are transferred or shared between atoms. Breaking a chemical bond requires energy. Formation of a chemical bond releases energy. Ionic compounds result from atoms transferring electrons. Molecular compounds result from atoms sharing electrons. For example, carbon atoms can bond to each other in chains, rings, and branching networks. Branched network and metallic solids also result from bonding.	**KS2A.2.3**	a. Valence electron configurations determine whether an atom gains, loses, or shares electrons to achieve a more stable electron configuration similar to the noble gases. b. Positively charged ions are called cations, and negatively charged ions are called anions. Cations are attracted to anions (opposite charges attract). Most cations are metals; most anions are nonmetals. In stable ionic compounds, the sum of the charges is zero. c. Covalent bonds form when two or more atoms share one or more pairs of electrons to achieve a more stable electron configuration. The two classifications of covalent bonds are nonpolar and polar. The greater the electronegativity difference between atoms involved in the bond, the more polar the bond. d. The energy required to break ionic bonds is greater than the energy required to break covalent bonds. Heat exchange during a chemical reaction is often easily noticed: a reaction that absorbs heat will feel colder; a reaction that releases heat will feel warmer. e. Carbon atoms can bond to each other	September October

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		in chains, rings, and branching networks to form a variety of molecular structures including relatively large molecules essential to life. Diamonds, a 3-dimensional branching of carbon atoms and quartz, a repeated 3-dimensional branching of silicon dioxide molecules, are further examples of network solids. Unique properties of network solids include hardness, high melting points, poor conductors - indicative of covalent bonding and stable geometry. f. Metallic bonding is defined as free roaming electrons forming a negative sea of electrons surrounding the positive metal ions.	
▲understands a chemical reaction occurs when one or more substances (reactants) react to form a different chemical substance(s) (products). There are different types of chemical reactions all of which demonstrate the Law of Conservation of Matter and Energy.	**KS2A.3.1**	a. Chemical reactions are written as balanced chemical equations. In ordinary chemical reactions, the number and kind of atoms must be conserved. b. Examples of chemical reactions are synthesis, decomposition, combustion, single and double replacement, acid/base, and oxidation/reduction. c. Two or more of the following may often identify chemical reactions: physical property change, effervescence, mass change, precipitation, light emission, and heat exchange. d. The rate (speed) of a chemical reaction depends on such parameters as temperature, concentration, catalysts, inhibitors, surface area, and reaction type.	October November
understands how to perform mathematical calculations regarding the Law of Conservation of Matter, i.e., through stoichiometric relationships.	KS2A.3.2	a..Reaction stoichiometry involves understanding the use of coefficients (moles) to balance equations and solve for a variety of relationships using the molar mass of the substances. Examples of these types of relationships include mole/mole, mole/mass, mole/volume, mass/volume, mass/mass, etc.	November
understands the differences and reactions between acids, bases, and salts. Perform calculations to determine the concentration of ions in solutions.	KS2A.3.3	a. Acids react with bases to produce water and salt. b. pH is a logarithmic function of hydronium ion concentration. pH decreases as the hydronium ion concentration increases. pOH and hydroxide concentrations are found in a	April

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		similar way.	