**NACA Chemistry Year Long UbD**

**Designer:** Robert Salazar

**Date:** 2015-16

|  |  |  |
| --- | --- | --- |
| **Stage 1 - Desired Results** | | |
| Directions: Choose multiple CCSS (or other standards), copy and paste them here, and unpack them for big ideas and assessment verbs by highlighting. | | |
| **NGSS - Disciplinary Core Ideas** | | |
| PS1.A: Structure and Properties of Matter   * Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) * The periodic table orders elements horizontally by the number of protons in the atom’s nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2) * The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),(secondary to HS-PS2-6) * A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)   PS1.B: Chemical Reactions   * Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5) * In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6) * The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)   PS1.C: Nuclear Processes   * Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8) * Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary to HS-ESS1-5),(secondary to HS-ESS1-6)   PS2.B: Types of Interactions   * Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6),(secondary to HS-PS1-1),(secondary to HS-PS1-3)   PS3.A: Definitions of Energy   * Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system’s total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) * At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3) * These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)   PS3.B: Conservation of Energy and Energy Transfer   * Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) * Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) * Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) * The availability of energy limits what can occur in any system. (HS-PS3-1) * Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4)   PS3.D: Energy in Chemical Processes   * Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-4) * Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1)   PS4.B: Electromagnetic Radiation   * Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)   ESS1.A: The Universe and Its Stars   * The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1) * The study of stars’ light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3) * The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2) * Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3) * Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth’s formation and early history. (HS-ESS1-6)   ESS2.B: Plate Tectonics and Large-Scale System Interactions   * Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth’s surface and provides a framework for understanding its geologic history. (ESS2.B Grade 8 GBE) (secondary to HS-ESS1-5)     ESS2.C: The Roles of Water in Earth's Surface Processes   * The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. These properties include water’s exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5)   ETS1.C: Optimizing the Design Solution   * Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6) | | |
| **NGSS - Performance Expectations** | | |
| * HS-PS1-1. Use the **periodic table** as a **model** to predict the **relative properties** of **elements** based on the **patterns of electrons** in the **outermost energy level** of **atoms**. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.] * HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.] * HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [Assessment Boundary: Assessment does not include Raoult’s law calculations of vapor pressure.] * HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.] * HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.] * HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.\* [Clarification Statement: Emphasis is on the application of Le Chatelier’s Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.] * HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students’ use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.] * HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]" * HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]" * HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components; and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.]" * HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). [Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.] * HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.] [Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students.] * HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy in the form of radiation. [Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun’s core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun’s radiation varies due to sudden solar flares (“space weather”), the 11-year sunspot cycle, and non-cyclic variations over centuries.] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with the sun’s nuclear fusion.] * HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. [Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).] * HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements. [Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.] [Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.] * HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth’s oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]" * HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).] * HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. * HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. * HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. * HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem." | | |
| **NGSS - Crosscutting Concepts** | | |
| Patterns   * Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5)   Energy and Matter   * In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8),(HS-ESS1-3) * The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) * Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4) * Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2),(HS-ESS1-2)   Stability and Change   * Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6), (HS-ESS1-6)   Structure and Function   * Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6) * The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)   Systems and System Models   * When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4) * Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1)   Scale, Proportion, and Quantity   * The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) | | |
| **NGSS - Science and Engineering Practices** | | |
| Developing and Using Models   * Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). * Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) * Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8),(HS-PS3-2), (HS-ESS1-1)   Planning and Carrying Out Investigations   * Planning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. * Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3),(HS-PS3-4),(HS-ESS2-5)   Using Mathematics and Computational Thinking   * Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. * Use mathematical representations of phenomena to support claims. (HS-PS1-7) * Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1)   Constructing Explanations and Designing Solutions   * Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. * Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) * Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2),(HS-ESS1-2) * Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) * Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6)   Obtaining, Evaluating, and Communicating Information   * Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. * Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6),(HS-ESS1-3) | | |
| **NGSS - Nature of Science** | | |
| Scientific Knowledge Assumes an Order and Consistency in Natural Systems   * Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7),(HS-PS3-1),(HS-ESS1-2) * Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-ESS1-2) | | |
| **NGSS - Engineering,Technology, and Applications of Science** | | |
| Interdependence of Science, Engineering, and TechnologyScience and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-2) | | |
| **CCSS - ELA/Literacy** | | |
| * RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS1-6) * WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-ESS1-6) * WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),(HS-PS1-5),(HS-PS2-6),(HS-ESS1-2),(HS-ESS1-3) * WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2) * WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),(HS-PS1-6),(HS-PS3-4),(HS-ESS2-5) * WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3),(HS-PS3-4) * WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3),(HS-PS3-4) * SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-ESS1-3) * SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4),(HS-PS3-1),(HS-PS3-2) | | |
| **CCSS - Mathematics** | | |
| * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) * HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4) * HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1),(HS-ESS1-2) * HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1),(HS-ESS1-2) * HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6) * HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6) | | |
| **Indigenous Standards** | | |
| **Community/Service:**   * Recognize, serve and sustain for future generations, a community that includes people, the environment and all living things.   **Reflection:**   * Make connections between diverse culture by identifying themes and archetypes while remaining specific to a time and place. * Evaluate diverse perspectives, claims and evidence by corroborating or challenging them with other information. * Develop a creative learning process that uses reflection to transform and improve personal and community well-being. * Demonstrate self-knowledge by showing meta-cognitive awareness, using productive habits of mind, and reflecting on the meaning of the learning and experience.   **Culture:**   * Actively cultivate and express one’s own identity/story and find connections with other’s identity/story in order to create ongoing resilient change. * Demonstrate empowerment through language, stories, spirituality, song, art, dance, and food.   **Respect:**   * Cultivate harmonious relationships that value self, all individuals and their environment through active listening, mindfulness and thoughtful consideration in order to create places of belonging and community.   **Responsibility:**   * Plan daily responsibility to our people, past-present-future, as well as our environment through words, actions and conduct that embodies trustworthiness and accountability in all that we do.   **Perseverance:**   * Use self-determination, commitment and traditional cultural teachings to develop resiliency in the face of adversity. | | |
| **Other - *Other than the big ideas explicitly in the standards you chose, what big ideas might frame a unit?*** | | |
| * environmentalism, conservation, sustainability, | | |
| CHOSEN BIG IDEA(S):  **Energy**  **Science and Engineering Cycles** | **Transfer** | |
| **Students will be able to independently use their learning to…**  I want my students to \_\_\_\_\_\_\_\_\_\_, so that in the long-run, on their own, they will be able to \_\_\_\_\_\_\_\_\_\_\_\_\_.   * evaluate the reliability of scientific claims, so that they can make wise choices that affect themselves and their communities * develop and analyze solutions to engineering problems and opportunities, so that they address the challenges that affect themselves and their communities * communicate effectively about technical issues, so that they can actively participate in decision making processes that affect themselves and their communities * model natural systems and processes, so that they can analyze the effects of changes to those systems and processes * plan and conduct investigations, so that they can analyze issues that are relevant to their lives and communities. * model using mathematics and computation, so that they can make sense of abstract concepts and develop solutions to complex issues. * construct explanations of phenomena based on evidence, so that they can determine the validity of explanations. | |
|
| **Meaning** | |
| UNDERSTANDINGS  *Students will understand that...*   * Energy drives all systems * Scientific thinking helps us understand our world and improve the lives of future generations. | ESSENTIAL QUESTIONS   * How does scientific understand help us understand our world? * How do we use science to improve the lives of future generations? * How do we determine what is true? |
| **Acquisition** | |
| *Students will know…*   * Unit 1 - Atoms, Elements, & the Periodic Table   + Master     - atom     - charge     - nucleus     - proton     - neutron     - electron     - quantitative     - qualitative     - periodic table     - model     - property     - element     - electron pattern     - energy level   + Spiral | *Students will be skilled at…*   * Unit 1 -   + Master     - Use models to make predictions about relationships     - Translate quantitative or technical information between text, mathematical, and visual forms     - Predict the relative properties of elements   + Spiral |
|  | * Unit 2 - 2 - Molecules & Compounds   + Master     - Structure     - Interaction     - matter     - scale     - electrical forces     - atoms     - attraction     - repulsion     - bulk scale     - atomic scale     - property     - transformation     - contact force     - properties of water (heat capacity, expansion on freezing, solvent, effect on viscosity & melting point)     - functions     - system     - natural vs. designed     - molecule     - molecular substructure     - Investigation     - evidence     - Particle     - scientific information     - technical information     - Earth materials     - Earth surface processes   + Spiral | * Unit 2 -   + Master     - Plan an investigation     - Conduct an investigation     - Compare bulk structure to interparticle forces     - Communicate scientific and technical information   + Spiral |
|  | Unit 3 - 3 - Chemical Reactions   * Master   + Periodic Table   + proton   + nucleus   + atomic number   + chemical properties   + outer electron states   + conservation of mass   + energy   + closed system   + conserve   + matter   + mathematical representation   + Stages of Writing (planning, revising, editing, rewriting)   + chemical reaction   + trends in periodic table   + patterns of chemical properties * Spiral | Unit 3 -   * Master   + describe chemical reactions   + predict chemical reactions   + use mathematical representations to support claims   + Develop and strengthen writing   + Construct explanation for the outcome of a simple chemical reaction   + Revise an explanation for the outcome of a simple chemical reaction   + use mathematical representations   + support the claim that atoms and mass are conserved * Spiral |
|  | Unit 4 - 4 - Thermochemistry (No Reaction)   * Master   + conservation of energy   + system   + total energy   + energy transfer   + energy transport   + mathematical expression   + stored energy   + kinetic energy   + energy availability   + Uncontrolled systems   + stable states   + energy distribution   + energy transformation   + boundary conditions   + initial conditions   + input   + output   + model   + precision   + reliability   + assumptions   + approximations   + data   + evidence   + data types, quantities, accuracy   + measurements   + precision   + computational model   + simulation   + relevance   + authoritative source   + advanced searches   + source strength & limitation   + audience   + flow of ideas   + plagiarism   + overreliance on a source   + citation format   + energy flow   + thermal energy   + thermodynamics   + 2nd law of thermodynamics   + closed system   + temperature * Spiral | Unit 4 -   * Master   + Predict and describe system energy behavior   + Define boundary and initial conditions   + Analyze inputs and outputs using models   + Predict the behavior of a system using models   + Plan investigations   + conduct investigations   + decide on type, quantity, accuracy of data needed   + consider limitations on precision of data   + refine investigation design   + create a computational model or simulation   + Gather relevant information from print   + use advanced searches effectively   + assess the strengths & limitations of a source   + integrate information into text to maintain flow   + avoid plagiarism   + avoid over reliance on a single source   + follow standard citation format   + Draw evidence from informational texts   + calculate the change in energy of components in a system   + provide evidence of second law of thermodynamics * Spiral |
|  | Unit 5 - 5 - Thermochemistry (Reaction)   * Master   + molecule stability   + heat of formation   + energy   + energy conservation   + energy transfer   + energy forms   + thermal energy   + light   + motion   + sound   + macroscopic scale   + microscopic scale   + energy stored in fields   + digital media   + energy release   + energy absorption   + chemical reaction system   + bond energy   + relative position * Spiral | Unit 5 -   * Master   + Describe changes in energy and matter as flows in systems   + use digital media to enhance understanding and add interest   + Develop and use models   + Illustrate that energy loss or gained depends on bond energy changes   + Illustrate that energy at macro scale is energy from particle motion and relative position * Spiral |
|  | Unit 6 - 6 - Reaction Rates & Equilibrium   * Mastery   + Chemical processes   + chemical reaction rates   + energy storage   + energy release   + collision theory   + molecules   + rearrangement of atoms   + sum of bond energies   + kinetic energy   + dynamic balance   + condition-dependent balance   + reverse reaction   + criteria   + trade-offs   + patterns   + scale   + system   + causality   + scientific principles   + scientific evidence   + design problems   + unanticipated effects   + real-world problem   + scientific knowledge   + prioritized criteria   + tradeoff considerations   + research projects   + multiple sources   + temperature   + concentration   + reaction rate   + chemical system   + condition change   + products   + equilibrium * Spiral | Unit 6 -   * Mastery   + break down criteria into simpler criteria   + approach criteria systematically   + prioritize criteria   + observe patterns at different scales   + provide evidence for causality   + apply scientific principles   + apply scientific evidence   + provide explanations of phenomena   + solve design problems   + take into account possible unanticipated effects   + refine solutions   + conduct research projects   + generate questions   + solve problems   + narrow inquiry when appropriate   + broaden inquiry when appropriate   + synthesize multiple source   + demonstrate understanding of an investigated subject   + provide an explanation about the effects of temperature or concentration change on reaction rate   + refine design of chemical systems at equilibrium * Spiral |
|  | Unit 7 - 7 - Nuclear Reactions   * Mastery   + nuclear processes   + fusion   + fission   + radioactive decay   + unstable nuclei   + release of energy   + absorption of energy   + neutron   + proton   + conservation of neutrons plus protons   + multiple formats of communication   + claims   + findings   + salient points   + focus   + coherence   + relevance   + evidence   + sound valid reasoning   + details   + adequate volume   + appropriate eye contact   + changes to nucleus composition   + energy release   + stars   + star life cycles   + stellar element production * Spiral | Unit 7 -   * Mastery   + communicate scientific and technical information   + present claims and findings   + emphasize salient points   + choose details   + use appropriate eye contact   + use adequate volume   + use clear pronunciation   + develop models   + illustrate changes during fusion, fission, and radioactive decay   + communicate scientific ideas * Spiral |
|  | Unit 8 - Astronomy   * Mastery   + nuclear fusion   + sun   + energy   + Earth   + radiation   + atom   + element   + emission   + absorption   + frequency   + light   + characteristics   + spectroscopy   + star   + star lifespan   + sun lifespan   + light spectra   + star distance   + star movement   + big bang theory   + galaxy   + galaxy recession   + star composition   + non-stellar gases   + cosmic microwave background   + universe   + hydrogen   + helium   + nuclear fusion in stars   + atomic nuclei   + iron   + electromagnetic energy   + supernova   + heavy element creation   + conservation of energy   + energy fields   + system   + object   + significance   + phenomenon   + scale   + proportion   + quantity   + model   + evidence   + components   + validity   + reliability   + source   + investigation   + theory   + simulation   + peer review   + law   + consistency of theories and laws   + science   + engineering   + research & development cycle   + scientists   + engineers   + experts   + informative texts   + explanatory texts   + scientific procedures   + scientific explanations   + technical processes   + model   + expression   + quantity   + context   + equation   + variable   + relationship   + graph   + coordinate axes   + labels   + scales   + rearranging formulas   + formulas   + evidence for the Big Bang theory * Spiral | Unit 8 -   * Mastery   + identify the presence of an element using spectroscopy   + identify the compositional elements of stars   + identify the movement of stars   + determine the distance of stars   + develop model   + use model   + illustrate relationships in and between systems   + construct explanations based on evidence   + revise explanations based on evidence   + write informative/explanatory texts   + model mathematically   + interpret expressions in context   + create equations in 2+ variables   + represent relationships between quantities   + graph equations   + rearrange formulas   + develop a model of solar processes & lifespan   + construct an explanation of the Big Bang Theory * Spiral |
|  | Unit 9 - Geology   * Mastery   + spontaneous radioactive decay   + exponential decay law   + nuclear lifetimes   + radiometric dating   + rocks   + plate tectonics   + erosion   + changing early rock record   + lunar rocks   + asteroids   + meteorites   + sources of information about Earth’s formation and early history   + Earth’s formation   + Earth’s early history   + change   + stability   + scientific reasoning   + evidence   + claims   + data   + explanations   + conclusions   + textual evidence   + science and technical texts   + author’s distinctions   + gaps or inconsistencies   + hypotheses   + analysis   + conclusion   + verification   + corroboration   + sources   + arguments   + abstract reasoning   + units   + scale   + origin   + graphs   + data displays   + quantities   + descriptive modeling   + accuracy   + measurement limitations   + significant digits   + domain   + function   + quantitative relationships   + scatter plot * Spiral | Unit 9 -   * Mastery   + determine the ages of rocks and other materials using radiometric dating   + construct explanations of how things change   + construct explanations of how things remain stable   + apply scientific reasoning   + link evidence to claims   + assess the extent to which reasoning and data support explanations or conclusions   + cite textual evidence   + analyze science and technical texts   + attend to important author’s distinctions   + attend to gaps or inconsistencies in accounts   + evaluate hypotheses, data, analysis, and conclusions in scientific or technical texts   + verify data when possible   + corroborate or challenge conclusions with other sources   + write arguments   + reason abstractly   + reason quantitatively   + use units to understand problems   + use units to guide solution of multi-step problems   + choose units in formulas   + interpret units in formulas   + choose scale and origin   + interpret scale and origin   + devine quantities for descriptive modeling   + choose accuracy levels   + report quantities   + relate domains of functions to graphs   + relate domains of functions to quantitative relationships   + represent data (2 variables) on a scatter plot   + describe the relationship of 2 variables on a scatter plot   + apply scientific reasoning   + construct an account of Earth’s formation and early history from evidence * Spiral |

|  |  |
| --- | --- |
| **Stage 2 - Evidence** | |
| **Evaluative Criteria** | **Assessment Evidence** |
| **Standards-based A+ Rubric in Student-friendly Language**   |  | | --- | | Developing and Using Models   * Develops a model based on evidence * Model shows relationships between systems OR between components of a system * Uses model to predict relationships | | Planning and Carrying Out Investigations   * Plans an investigation * Investigation produces data that can be used as evidence * Chooses the type, amount, and accuracy of data needed * Analyzes limitations on precision * Refines design to improve precision | | Using Mathematics and Computational Thinking   * Include a student-generated computational model * Analyzes mathematically to support conclusions | | Constructing Explanations and Designing Solutions   * Applies scientific principles and evidence in explanation/solution design * Consider unanticipated effects * Revise explanation * Use valid and reliable evidence * Evidence comes from multiple sources * Extrapolates evidence to past/future/external situations * In creating solutions, prioritizes criteria and tradeoffs * Connects evidence to claims * Assess the degree to which reasoning and data support explanation/conclusion. | | Obtaining, Evaluating, and Communicating Information   * Communicate information about the development, design, and performance in multiple formats. | | **PERFORMANCE TASK(S):**   * Analysis of a chemistry related community issue, including recommendations for addressing the issue   + Evaluation of reliability of relevant scientific claims   + Modeling of the systems and processes involved in the issue   + Using the model to analyze potential changes to the systems and processes   + developing and analyzing solution(s) to the issue   + communicating findings and recommendations in technical and comprehensible manner.     **What (cognitive verb + big idea):**  Investigate scientific questions and engineering problems  Evaluate scientific explanations and engineering solutions  Develop scientific explanations and engineering solutions  **Why (copied and pasted EUs from Stage 1):**  Scientific thinking helps us understand our world and improve the lives of future generations.  **How (GRASPS, written to and for students):**   * **Goal:** Investigate concept/problem relevant to chemistry, community, and identity * **Role:** Community Member * **Audience:** Community * **Situation:** Research symposium & community presentation * **Product, Performance, and Purpose:** Presentation of findings and/or solutions * **Standards and Criteria for Success:** Proficiency on key sections of the NACA Science & Engineering Practices Rubric |
|  | **Other Evidence:**  Final Exam - Assesses content knowledge (EOC) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stage 3 - Learning Plan** *What lessons will you teach, and what skills will students master, as a result of this unit?* | | | | |
| 2015-16 Curriculum Map | | | | |
| Unit Big Idea (Title) | Unit Essential Question(s) | Unit Standard(s) | Assessment(s) | Time Frame |
| What big idea anchors this unit? | What EQ will anchor conceptual, critical thinking related to the big idea? | What core standard(s) anchors this unit, and therefore what observable skills will you evaluate ? | What summative assessment will provide you evidence of skills and understanding? | What is the approximate time frame for the teaching and learning in this unit? |
| 1 - Introduction to Chemistry | Why is it important to study chemistry?  How do chemists solve problems?  What properties are used to describe matter?  How can matter change its form? | Structure and Function   * Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6) * The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) * HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4) | * HS-PS1-1. Use the **periodic table** as a **model** to predict the **relative properties** of **elements** based on the **patterns of electrons** in the **outermost energy level** of **atoms**. (assessed in Unit 2) * Unit Test | Weeks 2-5 |
| 2 - Atoms, Elements, & the Periodic Table | How can we use the periodic table to understand and predict the properties of elements? | * Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) * The periodic table orders elements horizontally by the number of protons in the atom’s nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2) * Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6),(secondary to HS-PS1-1),(secondary to HS-PS1-3) * Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5) * Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) * RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1) | * HS-PS1-1. Use the **periodic table** as a **model** to predict the **relative properties** of **elements** based on the **patterns of electrons** in the **outermost energy level** of **atoms**. | Weeks 6-9 |
| 3 - Molecules & Compounds | How are the properties of substances related to the structure of and interactions between the substances’ particles?  How does water affect the Earth’s materials and surface processes? | * The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),(secondary to HS-PS2-6) * Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6),(secondary to HS-PS1-1),(secondary to HS-PS1-3) * The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. These properties include water’s exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5) * Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5) * The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5) * Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3),(HS-PS3-4),(HS-ESS2-5) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),(HS-PS1-6),(HS-PS3-4),(HS-ESS2-5) * WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3),(HS-PS3-4) * WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3),(HS-PS3-4) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. * HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. * HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. | Weeks 10-13 |
| 4 - Chemical Reactions | What happens at the molecular level during a chemical reaction? | * The periodic table orders elements horizontally by the number of protons in the atom’s nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2) * The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7) * Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5) * The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) * Use mathematical representations of phenomena to support claims. (HS-PS1-7) * Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2),(HS-ESS1-2) * Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7),(HS-PS3-1),(HS-ESS1-2) * WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),(HS-PS1-5),(HS-PS2-6),(HS-ESS1-2),(HS-ESS1-3) * WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. * HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. | Weeks 14-17 |
| 5 - Thermochemistry (No Reaction) | How does energy flow within and between systems? | * Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system’s total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) * Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1) * Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) * Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) * The availability of energy limits what can occur in any system. (HS-PS3-1) * Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4) * Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-4) * When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4) * Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1) * Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3),(HS-PS3-4),(HS-ESS2-5) * Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1) * Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7),(HS-PS3-1),(HS-ESS1-2) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),(HS-PS1-6),(HS-PS3-4),(HS-ESS2-5) * WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3),(HS-PS3-4) * WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3),(HS-PS3-4) * SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4),(HS-PS3-1),(HS-PS3-2) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. * HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). | Weeks 19-21 |
| 6 - Thermochemistry (Reaction) | How does the energy in a system change during a chemical reaction? | * A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) * Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5) * Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system’s total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1),(HS-PS3-2) * At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3) * These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2) * Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4) * Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2),(HS-ESS1-2) * Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8),(HS-PS3-2), (HS-ESS1-1) * SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4),(HS-PS3-1),(HS-PS3-2) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. * HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). | Weeks 22-24 |
| 7 - Reaction Rates & Equilibrium | How can we control reaction rates and equilibrium states to improve our communities? | * Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5) * In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6) * Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6) * Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5) * Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6), (HS-ESS1-6) * Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) * Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),(HS-PS1-5),(HS-PS2-6),(HS-ESS1-2),(HS-ESS1-3) * WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3),(HS-PS1-6),(HS-PS3-4),(HS-ESS2-5) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. * HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.\* | Weeks 25-27 |
| 8 - Nuclear Reactions | How are elements produced and changed? | * Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8) * The study of stars’ light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3) * Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3) * In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8),(HS-ESS1-3) * Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8),(HS-PS3-2), (HS-ESS1-1) * Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6),(HS-ESS1-3) * WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),(HS-PS1-5),(HS-PS2-6),(HS-ESS1-2),(HS-ESS1-3) * SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-ESS1-3) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) | * HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. * HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements. | Weeks 28-30 |
| Unit 9 - Astronomy | How was the universe formed?  How does the Sun produce energy? | * Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1) * Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2) * The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1) * The study of stars’ light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3) * The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2) * Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2),(HS-ESS1-3) * Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2),(HS-ESS1-2) * The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) * Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8),(HS-PS3-2), (HS-ESS1-1) * Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2),(HS-ESS1-2) * Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7),(HS-PS3-1),(HS-ESS1-2) * Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-ESS1-2) * Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-2) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2),(HS-PS1-5),(HS-PS2-6),(HS-ESS1-2),(HS-ESS1-3) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * MP.4 Model with mathematics. (HS-PS1-4),(HS-PS1-8),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) * HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4) * HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1),(HS-ESS1-2) * HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1),(HS-ESS1-2) | * HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy in the form of radiation. * HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. | Weeks 31-33 |
| Unit 10 - Geology | How was the Earth formed? | * Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary to HS-ESS1-5),(secondary to HS-ESS1-6) * Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth’s formation and early history. (HS-ESS1-6) * Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6), (HS-ESS1-6) * Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6) * RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3),(HS-PS1-5),(HS-PS2-6),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS1-6) * WHST.9-12.1 Write arguments focused on discipline-specific content. (HS-ESS1-6) * MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-PS3-1),(HS-PS3-2),(HS-PS3-4),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-6) * HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6) * HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2),(HS-PS1-3),(HS-PS1-4),(HS-PS1-5),(HS-PS1-7),(HS-PS1-8),(HS-PS2-6),(HS-PS3-1),(HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-6),(HS-ESS2-5) * HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6) * HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6) | * HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history. | Weeks 34-36 |