NM Public Education Department

SCIENCE: CHEMISTRY

END-OF-COURSE EXAM | GRADE 9–12 | YEAR 18–19

ASSESSMENT BLUEPRINT

Purpose Statement
Chemistry

The Chemistry End-of-Course (EOC) exam is intended to measure student proficiency of the New Mexico Science Standards. This course-level exam is provided to all students who have completed Chemistry or related courses.
This exam can be given for the following STARS course codes:

1721 - Chemistry-First Year
1723 - Chemistry Advanced Studies
1725 - AP Chemistry

Intended as a final exam for the course, this is a summative assessment covering a range of content, skills, and applications. Scores are reported to the teacher, school, district, and state levels for the purposes of student grades, curriculum review, and NMTeach summative reports.

"The EOCs are exams written by New Mexico Teachers for New Mexico Students."
During the 2018 summer, teachers were brought together in person or online as part of the blueprint and exam revision process. The NM PED extends our gratitude to all those who contributed to this improvement process. Although we were unable to implement every suggestion due to conflicting viewpoints at times, this blueprint reflects the best collaborative effort among dedicated peers.

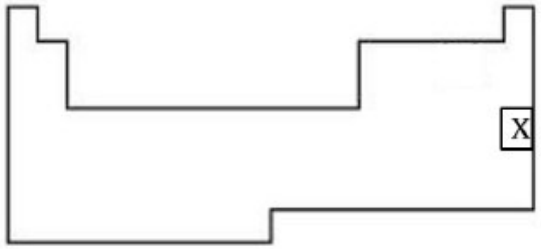
The NM PED would like to especially recognize the following people who led the revision of this blueprint:

- *Geizi Llanes - Dejka, Farmington Municipal Schools, Blueprint Lead*
- *Anastacia Cadena, Alamogordo Public Schools*
- *Dana Cantrell, Alamogordo Public Schools*
- *Irina Cislaru, Santa Fe Public Schools*
- *Joy Rosario, Central Consolidated Schools*
- *Larie Laudato, Gallup-McKinley County Schools*
- *Emily Clauss, Albuquerque Public Schools*

Explanation of Blueprint Layout & Test Specifications Table

Topics	Clarifications on Test Item Specifications:
The performance expectations (PEs) identified in this portion of the blueprint are aligned to the New Mexico STEM Ready! Science Standards. *The PEs have been deconstructed to highlight the three dimensionality. Consult your NM STEM Ready! Standards for the full PE:* *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/* *and High School Recommended Discipline-Specific Course Map:* *https://webnew.ped.state.nm.us/bureaus/math-science/nm-stem-ready-science/nm-stem-ready-science-standards/recommended-secondary-course-maps/* *New Mexico Teachers identified the PEs to be measured on the EOC exam using the following criteria: 1) a great deal of instructional time is spent on the PE as identified in the curriculum and/or; 2) the PE is important to subsequent learning.* *It is important to note that the PEs in the blueprint are only a* ***subset*** *of PEs to be measured with the understanding that teachers cover more PEs during the course of instruction than what has been selected to be measured.*	● *This portion of the blueprint identifies the DCI that students will have to demonstrate knowledge of during the exam. These items are not fully aligned to the Science and Engineering Practices (SEPs) and the crosscutting concepts (CCCs).* ● *Although the PE measures other dimensions, the item specifications may place constraints on portions of the DCI in order to provide more transparency as to what specifically will be measured relative to the PE.* ● *Items on this year's NM STEM Ready! transition EOC are content aligned and are items from the existing EOC and/or SBA item banks. PED will be field testing NM STEM Ready! cluster items for EOCs, which are optional for school participation.*
	Item Types: *The item types for this EOC exam are limited to:* *MC = multiple choice with or without stimulus (e.g., picture, graph, chart)*
	Sample Question: *Sample questions have been provided for some PEs to assist teachers to correlate the questions with the performance standards and the test item specification, when applicable. Sample questions could not be provided for all PEs due to the limitations in the existing EOC and SBA item bank.* ● *An * denotes the correct answer* ● *DOK = Depth of Knowledge* ● *Some sample questions may be items released items from prior EOC exams*

Topic: Engineering Design	DCI with Test Item Specifications:
HS-ETS-1-3 **SEP**: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs **DCI**: that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. **CCC**: as well as possible social, cultural, and environmental impacts **Clarification Statement:** None **Assessment Boundary:** None	**<u>ETS1.B: Developing Possible Solutions</u>** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. **Essential Question:** **What is the process for developing potential design solutions?** **Item Types:** *MC = multiple choice with or without stimulus*

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-1 **SEP**: Use the periodic table as a model to predict **DCI**: the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. **CCC**: properties of elements based on the patterns of electrons **Clarification Statement:** Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, number 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.	**<u>PS1.A: Structure and Properties of Matter</u>** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. 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. **Essential Question:** **How are elements arranged in the Periodic Table of Elements?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question:  The figure shows a periodic table with the position of one element indicated by an X. How would the element in position 'X' be classified? (a) Halogen (b) Metal (c) Noble Gas * (d) Non-metal

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-3 **SEP**: Plan and conduct an investigation to gather evidence **DCI**: to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. **CCC**: to compare the structure of substances at the bulk scale to infer **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.	**<u>PS1.A: Structure and Properties of Matter</u>** The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. **<u>PS2.B: Types of Interactions</u>** 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. (secondary) **Essential Questions:** **What are the bulk properties of a substance (examples are melting & boiling point, volatility, surface tension)?** **What are the factors that affect the ability of the electrical attraction between particles?**
	Item Types: MC = multiple choice with or without stimulus
	Sample Question: Tushar has been given a mixture of sand and salt. Which of these methods could he use to separate the sand from the salt? (a) Heat the mixture to 300° C and collect the salt vapor. (b) Mix the mixture with water and filter it to collect the salt. Evaporate the water to collect the sand. (c) Mix the mixture with iron. Use a magnet to separate the sand from the salt. (d) Mix the mixture with water and filter it to collect the sand. Evaporate the water to collect the salt. *

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-8 **SEP:** Develop models to illustrate **DCI**: the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. **CCC**: the changes in the composition of the nucleus of the atom….. 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.	**<u>PS1.C: Nuclear Processes</u>** 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. **Essential Questions:** **What happens to the number of protons and neutrons in the nucleus of an atom before and after a radioactive decay?** **What is the identity of the emitted radioactive particles/emissions (alpha, beta and gamma)?** **Item Types:** MC = multiple choice with or without stimulus **Sample Question:** How many protons, neutrons, and electrons will an isotope with an atomic mass of 11 and an atomic number of 5 contain? (a) 5 protons, 5 neutrons and 6 electrons (b) 5 protons, 6 neutrons and 5 electrons * (c) 5 protons, 11 neutrons, and 5 electrons (d) 5 protons, 11 neutrons, and 11 electrons

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS2-6 **SEP:** Communicate scientific and technical information about why **DCI**: the molecular-level structure is important in **CCC**: 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.	**PS2.B: Types of Interactions** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations for matter, as well as the contact forces between material objects. **Essential Questions:** **How does the structure and properties of matter and the types of interactions of matter at the atomic scale determine the function of the chosen designed material(s)?** **How do you describe the effects that attractive and repulsive electrical forces between molecules have on the arrangement (structure) of the chosen designed material(s) of molecules (e.g., solids, liquids, gases, network solid, polymers)?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: Because electrons move freely within metals, which of the following is true? (a) Metals are brittle (b) Metal are good conductors of electricity * (c) Metals are poor conductors of electricity (d) Metals are dull

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:

HS-PS1-2 **SEP**: Construct and revise an explanation **DCI**: 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. **CCC**: 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.	**PS1.A: Structure and Properties of Matter** 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. **PS1.B: Chemical Reactions** 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. **Essential Questions:** **What are the predictable patterns of reactivity of elements at the macroscopic level as determined by using the periodic table?** **What happens to the reactants and products in a chemical reaction?**
	Item Types: MC = multiple choice with or without stimulus
	Sample Question: In the following unbalanced double replacement reaction, what are the correct products? $Na_2SO_4 + BaCl_2 \rightarrow$ (a) $BaSO_4 + NaCl$ * (b) $BaSO_4 + Na_2Cl_2$ (c) $BaNa_2 + Cl_2SO_4$ (d) $NaSO_4 + BaCl$

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-4 **SEP**: Develop a model to illustrate that **DCI**: the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. **CCC**: the release or absorption of energy from a chemical reaction system **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.	**PS1.A: Structure and Properties of Matter** 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. **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. **Essential Questions:** **What happens to chemical bonds during a chemical reaction?** **What happens during an endothermic and an exothermic reaction?**
	Item Types: MC = multiple choice with or without stimulus
	Sample Question: Which of the following statements describes the differences between endothermic and exothermic chemical reactions? (a) Energy is absorbed in endothermic reactions but is released in exothermic reactions. * (b) Energy is conserved in endothermic reactions but is not conserved in exothermic reactions. (c) Endothermic reactions involve changes in the nucleus of an atom, but exothermic reactions do not involve changes in the nucleus. (d) Endothermic reactions occur when electrons are shared between atoms, but exothermic reactions occur when electrons are transferred between atoms.

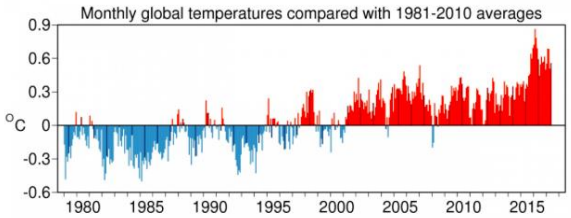
Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-5 **SEP**: Apply scientific principles and evidence to provide an explanation about **DCI**: the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. **CCC**: the effects of changing the temperature or concentration **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.	**<u>PS1.B: Chemical Reactions</u>** 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. **Essential Questions:** **What happens to the reaction rate when the kinetic energy of colliding particles and the number of collision increase?** **How does the collision of molecules affect chemical bonds?**
	Item Types: MC = multiple choice with or without stimulus
	Sample Question: A student observed that the rate of a chemical reaction increased as the temperature of the system increased. Which of the following statements best explains why thermal energy caused an increase in the reaction rate? (a) The surface area of the product particles decreased. (b) The collision rate of the reactant particles increased. * (c) The concentration of the reactant particles increased. (d) The concentrations of the product particles decreased.

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-6 **SEP**: Refine the design of a chemical system by specifying **DCI**: in conditions that would produce increased amounts of products at equilibrium. **CCC**: by specifying a change in conditions…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.	**PS1.B: Chemical Reactions** 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. **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) **Essential Question:** **What needs to be considered in redesigning a chemical system that will produce increased amount of product at equilibrium?** **Item Types:** MC = multiple choice with or without stimulus **Sample Question:** The Haber Process artificially combines atmospheric nitrogen with hydrogen to produce ammonia in the industrial scale. In 1994, the Port Neal fertilizer plant in Iowa that utilizes this process exploded and the effects of the blast was said to have been felt more than 30 miles away. As an engineer that has been contacted by Terra Nitrogen plant, you are asked to propose a design in rebuilding the factory that will prevent future explosions without compromising product yield. Below is the list of items that needs to be considered. Which combination of the following is the best choice to consider? I – Reliability II – Safety III – Employment IV – Cost V – Aesthetics VI – Environmental Impact (a) I, II, III, (b) I, II, IV (c) I, II, VI * (d) III, IV, VI

Topic: Structure and Properties of Matter	DCI with Test Item Specifications:
HS-PS1-7 **SEP**: Use mathematical representations to support the claim **DCI**: that atoms, ….. are conserved during a chemical reaction. **CCC**: that atoms, and therefore mass, are conserved. **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.	**PS1.B: Chemical Reactions** 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. **Essential Questions:** **What is the mathematical relationship between the masses of the atoms in the reactants and products during a chemical reaction?** **How does the conservation of mass in a chemical reaction be represented mathematically?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: When sodium hydroxide and magnesium chloride react, sodium chloride and magnesium hydroxide are formed. Which of the following is the correct balanced equation for the reaction? (a) $2\ NaOH + MgCl_2 \rightarrow 2NaCl + Mg(OH)_2$.* (b) $NaOH + MgCl \rightarrow NaCl + MgOH$ (c) $SOH + MgCl \rightarrow SCl + MgOH$ (d) $2SOH + MgCl \rightarrow SCl + Mg(OH)$

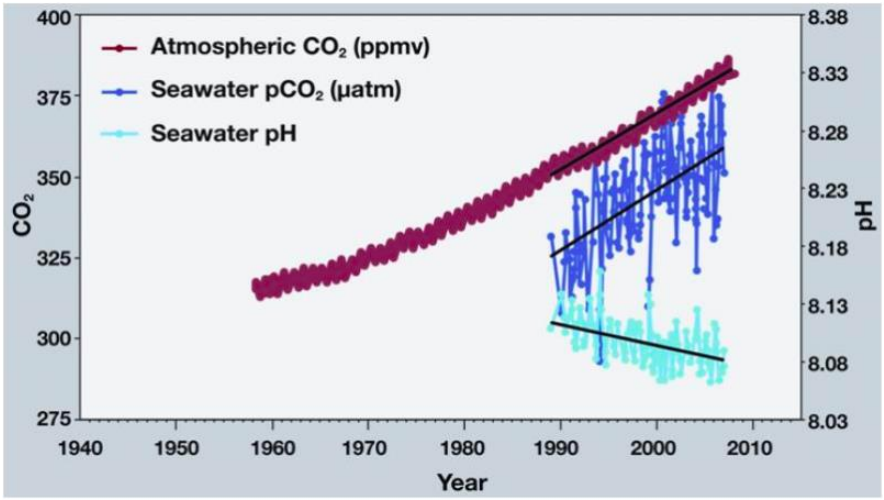
Topic: Energy	DCI with Test Item Specifications:
HS-PS3-4 **SEP**: Plan and conduct an investigation to provide evidence that **DCI**: the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). **CCC**: within a closed system results in a more uniform energy distribution among the components in the system **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.	**PS3.B: Conservation of Energy and Energy Transfer** Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. 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). **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. **Essential Questions:** **How is energy conserved in a closed system?** **What evidences can be used to show transfer of thermal energy between two components in the system?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** A student conducted an experiment to determine aluminum's specific heat. The student heats a 5.86 g of piece aluminum to various temperatures, then drops it into a calorimeter containing 25.0 mL of water. The following data is gathered during one of the trials: **Initial Temperature of Aluminum (°C)** = 109.1 **Initial Temperature of Water (°C)** = 23.2 **Final Temperature of Aluminum and Water (°C)** = 26.8 The student determined the following information by calculation after measuring the final temperature of aluminum and water combined given the specific heat of water as 4.18 J/g•°C: Specific Heat of Al = 0.780 J/g•°C Enthalpy Change for the cooling of Al in water = 1.73kJ/mol If the accepted specific heat of Aluminum is 0.900 J/g•°C which shows a percent error of 13.3%, which of the following is the most likely cause of the reduced value of aluminum's specific heat? (a) Some of the heat lost by the aluminum was not absorbed by water. (b) There is more than 25.0 mL of water in the calorimeter. (c) The metal used may not be Aluminum (d) All of the above. *

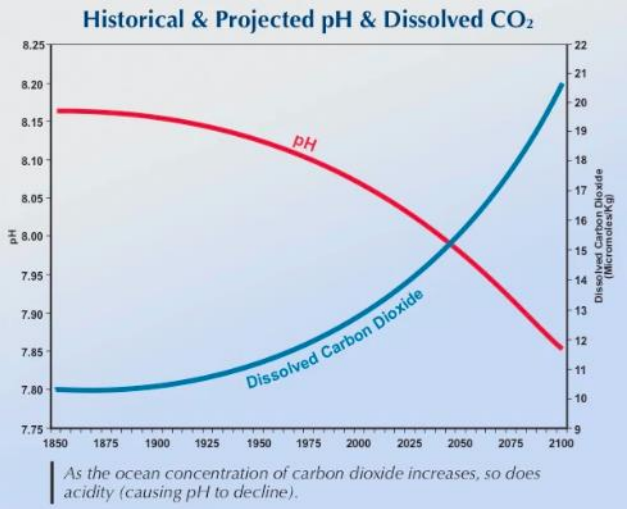
Topic: Energy	DCI with Test Item Specifications:
HS-PS3-5 **SEP**: Develop and use a model of **DCI**: two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. **CCC**: due to the interaction **Clarification Statement:** Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other. **Assessment Boundary:** Assessment is limited to systems containing two objects.	**<u>PS3.C: Relationship Between Energy and Forces</u>** When two objects interacting through a field change relative position, the energy stored in the field is changed. **Essential Questions:** **How is the energy affected when two objects (atom/molecule) interact?** **What happens to the electromagnetic attraction between atoms during chemical bonding?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** Chemical reactions between atoms ***only*** involve which of the following? (a) valence electrons * (b) neutrons (c) protons (d) inner shielding electrons

Topic: Earth's Systems	DCI with Test Item Specifications:
HS-ESS2-4 **SEP**: Use a model to describe how **DCI**: variations in the flow of energy into and out of Earth's systems result in changes in climate. **CCC**: results in **Clarification Statement:** Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition. **Assessment Boundary:** Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.	**<u>ESS1.B: Earth and the Solar System</u>** Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary) **<u>ESS2.A: Earth Materials and Systems</u>** The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. **<u>ESS2.D: Weather and Climate</u>** The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. **Essential Questions:** **How do Earth's major systems interact?** **How does human activity affect the Earth's climate?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: Refer to the diagram below and on your knowledge of Chemistry and Earth Science. The graph below shows variations in Earth's monthly temperature from January 1980 to December 2015.  *Figure. Courtesy of Copernicus Climate Change Service* The release of CH_4, CO_2 and water vapor in the atmosphere changes Earth's climate. The noted changes occur because these gases cause: (a) Cooler temperatures by absorbing ultraviolet radiation (b) Cooler temperatures by absorbing infrared radiation (c) Warmer temperatures by absorbing ultraviolet radiation (d) Warmer temperatures by absorbing infrared radiation *

Topic: Earth's Systems	DCI with Test Item Specifications:
HS-ESS2-5 **SEP**: Plan and conduct an investigation of **DCI**: the properties of water and its effects on Earth materials and surface processes. **CCC**: the properties of water and its effects **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). **Assessment Boundary:** None	**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. **Essential Questions:** **What properties of water affect Earth's materials and surface processes?** **How is water an agent for mechanical and chemical weathering?** **Item Types:** *MC = multiple choice with or without stimulus* **Sample Question:** Karst terrains are region where the bedrock is made of limestone. Sinkholes and caves in karst terrains are formed when limestones are dissolved by: (a) Weak carbonic acid contained in ground. * (b) Strong hypochlorite from acid rain (c) Strong hydrochloric acid from mine runoff (d) Weak sulfuric acid from animal remains

Topic: Human Sustainability	DCI with Test Item Specifications:
HS-ESS3-2 **SEP**: Evaluate competing design solutions for **DCI**: developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. **CCC**: based on cost-benefit ratios **Clarification Statement:** Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen. **Assessment Boundary:** None	**ESS3.A: Natural Resources** All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. **ETS1.B: Developing Possible Solutions** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. *(secondary)* **Essential Question:** **How do humans depend on Earth's resources?** **What is the process for developing potential design solutions?**
	Item Types: *MC = multiple choice with or without stimulus*

Topic: Human Sustainability	DCI with Test Item Specifications:
HS-ESS3-5 **SEP**: Analyze geoscience data…to make an evidence-based forecast of **DCI**: and the results from global climate models …..of the current rate of global or regional climate change and associated future impacts to Earth's systems. **CCC**: the current rate of **Clarification Statement:** Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition. **Assessment Boundary:** Assessment is limited to one example of a climate change and its associated impacts.	**<u>ESS3.D: Global Climate Change</u>** Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. **Essential Question:** **How is a geoscience data/model help in predicting a global climate change?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: According to the National Oceanic and Atmospheric Administration (NOAA), when corals are stressed by changes in conditions such as light, nutrients or temperature, they expel the symbiotic algae living in their tissues known as zooxanthellae. When this happens, corals turn completely white and this phenomenon is known as coral bleaching. According to atmospheric chemists and marine biologists, increasing CO_2 in the atmosphere due to anthropogenic activities not only affects climate but also greatly influences oceanic chemistry and thereby has also been hypothesized as a major influencing factor for massive coral bleaching in the Pacific waters. Base your answer from the graph below:  Figure from PMEL Carbon Program (Hawaii Carbon Dioxide Time Series). Modified from Feely et al. 2009. Approximately half of the CO_2 that are released by human activities is absorbed by the ocean. Although this seems to help reduce the rate of atmospheric warming, it has a direct influence on the chemistry of ocean water. The graph above tells us that: (a) The greater the atmospheric CO_2, the lower the seawater pH (b) The fishing industry greatly affects the amount of CO_2 in the atmosphere (c) The greater the amount of CO_2 absorbed by the oceans, the more acidic seawater becomes * (d) The higher the seawater pH, the lower the atmospheric CO_2

Topic: Human Sustainability	DCI with Test Item Specifications:
HS-ESS3-6 **SEP**: Use a computational representation to illustrate **DCI**: the relationships among Earth systems and how those relationships are being modified due to human activity. **CCC**: the relationship among Earth systems **Clarification Statement:** Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations. **Assessment Boundary:** Assessment does not include running computational representations but is limited to using the published results of scientific computational models.	**ESS2.D: Weather and Climate** Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary) **ESS3.D: Global Climate Change** Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. **Essential Questions:** **What are the current computational models showing us about the future of Earth's global climate?** **How does human activity affect the Earth's climate?**
	Item Types: *MC = multiple choice with or without stimulus*
	Sample Question: Refer to the graph below for your answer: Ocean Acidification occurs when atmospheric CO_2 enters the ocean and lowers its pH. When CO_2 reacts with seawater, it forms carbonic acid which causes the decrease in seawater pH. From the provided graph above, which from the choices below is the most likely cause of the increase in atmospheric CO_2? (A) Overfishing (B) Illegal Logging (C) Fossil Fuel use * (D) Dynamite Fishing  Source: Feely, Richard A., et.al. (2006) Carbon Dioxide and Our Ocean Legacy. Pew Trust

Chemistry Science - EoC Reporting Category Alignment Framework					
Reporting Category	**Performance Expectation**	**DOK (Count by DOK)**			**Grand Total**
		1	**2**	**3**	
Engineering Design (repeat)	HS-ETS1-1				
	HS-ETS1-2				
	HS-ETS1-3			1	**3**
	HS-ETS1-4				
Structure and Properties of Matter	HS-PS1-1	1			**1**
	HS-PS1-3	1			**1**
	HS-PS1-8		1		**2**
	HS-PS2-6		1	1	**5**
Chemical Reactions	HS-PS1-2		1		**2**
	HS-PS1-4		1		**2**
	HS-PS1-5		1		**2**
	HS-PS1-6			1	**3**
	HS-PS1-7			1	**3**
Energy	HS-PS3-1				
	HS-PS3-2				
	HS-PS3-3				
	HS-PS3-4			1	**3**
	HS-PS3-5	1			**1**
Earth's Systems	HS-ESS2-4		1		**2**
	HS-ESS2-5		1		**2**
	HS-ESS2-6				
Human Sustainability	HS-ESS3-2			1	**3**
	HS-ESS3-5			1	**3**

	HS-ESS3-6		1		**2**
New Mexico Specific Standard	HS-SS-1				
	Grand Total				**40**