Transitional Colorado Assessment Program (TCAP) Assessment Framework

Grade 10 Science

The assessment frameworks specify the content that will be eligible for assessment in the 2012 and 2013 TCAP by aligning the assessment objectives from the Colorado Model Content Standards (old standards) with the Colorado Academic Standards (new standards). TCAP supports the transition to the CAS during the next two years as a gradual approach to statewide measuring of student achievement of the new standards.

Please remember that the TCAP frameworks, and thus TCAP, are not inclusive of **all** of CAS. **Districts should, however, still transition to the full range of the new standards as the complete set of CAS will be considered eligible content for inclusion in the new 2014 assessment.**

The frameworks are organized as indicated in the table below:

Standard	Indicates the broad knowledge skills that all students should be acquiring in Colorado schools at grade level. Each standard is assessed every year.		
Benchmark	Tactical descriptions of the knowledge and skills students should acquire by each grade level assessed by the TCAP.		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
Specific knowledge and skills eligible for inclusion on TCAP for each grade level.	Provides the code(s) from the Colorado Academic Standards (CAS) that correspond(s) to the assessment objective.	Provides the text from the CAS which correspond(s) to the assessment objective.	Provides clarifying information.

The following may assist in understanding the revised frameworks:
The Colorado Academic Standards are mastery based. Some assessment objectives are aligned to expectations at 10th grade or below that are embedded throughout the CAS standards. Examples of expectation sentence stems are provided and these assessment objectives are eligible for assessment with the TCAP.

- A CAS may be aligned to multiple assessment objectives. To ensure a reasonable document length per grade, some instances of multiple CAS alignments have been omitted.

- Some assessment objectives, or parts of assessment objectives, do not explicit align with the CAS but will still be assessed. Where this occurs, it is noted with language such as "this will continue to be assessed." The concepts from these assessment objectives are also compiled in a table at the bottom of each framework for easy reference. The purpose of continuing to assess non-CAS aligned objectives is to ensure the reliability and comparability of the TCAP to prior year's assessments.

- Assessment objectives and parts of assessment objectives that will no longer be assessed have been struck through and are included in the revised frameworks for purposes of comparison to the prior frameworks only.

- Math is an integral part of science. The CAS has separated science related math concepts into distinct content area domains, but students should be able to interpret mathematical presentations of scientific data and trends in graphs, charts and tables.

- In some cases, an assessment objective is aligned to both an entire grade level expectation (GLE) and to a specific evidence outcome (EO) from that GLE. Text from the EO is included in these instances because it provides further clarification and may assist with interpretation of the framework.

- A key to the CAS Alignment Code can be by following this link:
  http://www.cde.state.co.us/cdeassess/UAS/AdoptedAcademicStandards/CAS_Reference_system.pdf

The revised frameworks directly build off of the work done on the original Colorado Student Assessment Program (CSAP) frameworks and reflect a joint endeavor between the Office of Assessment, Research and Evaluation and the content specialists from the Office of Academic and Instructional Support.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 1	Ask questions and state hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Plan and design a scientific investigation that includes: • developing a testable question for a scientific investigation • researching scientific literature • stating a hypothesis • stating a prediction • identifying the independent and the dependent variable • identifying the control and experimental groups • designing a written procedure for a controlled experiment • using an appropriate observation/ measurement technique • keeping all other conditions constant	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Develop and design a scientific investigation… Ask testable questions and make a falsifiable hypothesis about… and design a method to find an answer Use an inquiry approach to answer a testable question Ask testable questions about… and use an inquiry approach to investigate it Design an experiment to observe …, and clearly define controls and variables. Address differences between experiments where variables can be controlled and those where extensive observations on a highly variable natural system are necessary to determine what is happening	This objective is met in content-specific contexts within the CAS.
	SC09-GR.HS-S.2-GLE.5-N.1	Ask testable questions and make a falsifiable hypothesis about how cells transport materials into and out of the cell and use an inquiry approach to find the answer.	

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 1	Ask questions and state hypotheses using prior scientific knowledge to help design and guide development and implementation of a scientific investigation		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Describe different methods used to investigate scientific questions (e.g., controlled experiments, collecting specimens, constructing models, researching scientific literature etc.).	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Examine, evaluate, question, and ethically use information from a variety of sources and media Generate a model Use research… Research and present findings about…	This objective is met in content-specific contexts within the CAS.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 2	Select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Record and report data from a scientific investigation using the appropriate tools and metric units.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Employ data-collection technology to gather, view, analyze, and interpret data Use appropriate measurements, equations and graphs to gather, analyze, and interpret data Gather, analyze and interpret data and create graphs Use tools to gather, view, analyze, and interpret data	This objective is met in content-specific contexts within the CAS.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 2	Select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Describe how different types of technologies are used in scientific investigations.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Use tools to gather, view, analyze, and interpret data Examine how computer models are used Use remote sensing and geographic information systems (GIS) data Use appropriate technology to help gather and analyze data, find background information, and communicate scientific information	This objective is met in content-specific contexts within the CAS.
c. Use different types of visual methods to summarize, present, and analyze information related to an investigation.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Employ data-collection technology to gather, view, analyze, and interpret data Use appropriate measurements, equations and graphs to gather, analyze, and interpret data Gather, analyze and interpret data and create graphs Use tools to gather, view, analyze, and interpret data	This objective is met in content-specific contexts within the CAS.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 3	Identify major sources of error or uncertainty within an investigation (for example: particular measuring devices and experimental procedures)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify when an error has been introduced into a scientific investigation (e.g., certain variables are not controlled, measurements are read incorrectly, more than one variable is changed, etc.).	SC09-GR.7-S.1-GLE.1-N.2	Evaluate and critique experimental procedures designed to separate mixtures.	
	SC09-GR.8-S.1-GLE.3-N.1	Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results.	
	SC09-GR.HS-S.1-GLE.1-N.2	Share experimental data, respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement. Interpret and analyze data…	
	SC09-GR.HS-S.1-GLE.5-N.1	Critically evaluate scientific claims made in popular media or by peers regarding the application of energy forms, and determine if the evidence presented is appropriate and sufficient to support the claims.	
b. Describe a possible source for unexplained data/observations obtained from a scientific investigation, and explain how to evaluate this type of data/observations.	SC09-GR.8-S.1-GLE.3-N.1	Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results.	
	SC09-GR.HS-S.1-GLE.1-N.2	Share experimental data, respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement. Interpret and analyze data…	
	SC09-GR.HS-S.1-GLE.5-N.1	Critically evaluate scientific claims made in popular media or by peers regarding the application of energy forms, and determine if the evidence presented is appropriate and sufficient to support the claims.	
	SC09-GR.HS-S.2-GLE.1-N.2	Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.	
	SC09-GR.HS-S.2-GLE.2-EO.c	Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences	

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 3	Identify major sources of error or uncertainty within an investigation (for example: particular measuring devices and experimental procedures)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
c. Describe ways of keeping errors out of a scientific investigation (e.g., know only one variable can be changed, have the same person read measurements, record all data and observations because they may be needed to clarify unexpected results, etc.).	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others	
	SC09-GR.HS-S.1-GLE.1-N.2	Share experimental data, respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement.	

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 4	Recognize and analyze alternative explanations and models		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe and explain that alternative models can be used to investigate the same testable question.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Critically evaluate strengths and weaknesses of models Develop a model… Critically evaluate chemical and nuclear change models Use research-based models Examine how computer models are used…	This objective is met in content-specific contexts within the CAS.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 4	Recognize and analyze alternative explanations and models		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Describe and analyze other reasonable explanations, using the same independent and dependent variable, for the resulting data or observations from an investigation.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Debate Discuss the ethical and political issues Share experimental data, respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement Interpret and analyze data… Critically evaluate scientific claims made in popular media or by peers regarding the application of …, and determine if the evidence presented is appropriate and sufficient to support the claims	This objective is met in content-specific contexts within the CAS.

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 5	Construct and revise scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Explain how conclusions and models from previous scientific investigations need to be revised based on new evidence.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Understand that all scientific knowledge is subject to new findings and that the presence of reproducible results yields a scientific theory Understand how observations, experiments, and theory are used to construct and refine models Recognize that the current understanding of … has developed over time and become more sophisticated as new technologies have led to new evidence.	This objective is met in content-specific contexts within the CAS.
	SC09-GR.HS-S.3-GLE.1.N.1	Understand that all scientific knowledge is subject to new evidence and that the presence of reproducible results yields a scientific theory.	

Standard 1	Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations. Students know and are able to:		
Benchmark 6	Communicate and evaluate scientific thinking that leads to particular conclusions		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify and use evidence to support a particular conclusion.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Develop, communicate, and justify an evidence-based scientific explanation Gather, analyze and interpret data Critically evaluate scientific claims made in popular media or by peers regarding the application of …, and determine if the evidence presented is appropriate and sufficient to support the claims	This objective is met in content-specific contexts within the CAS.
	SC09-GR.HS-S.3-GLE.1-EO.b	Analyze and interpret data regarding Earth's history using direct and indirect evidence	
b. Identify and explain whether or not a conclusion is aligned with the testable question and the scientific investigation that was conducted.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Critically evaluate scientific claims made in popular media or by peers and determine if the evidence presented is appropriate and sufficient to support the claims. Critically evaluate…	This objective is met in content-specific contexts within the CAS.

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 1	Elements can be organized by their physical and chemical properties (Periodic Table)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Recognize that the Periodic Table is organized by atomic number and electron levels (horizontally into series/periods and vertically into families/groups), and explain why elements in the same family/group of the Periodic Table have similar properties. Use the Periodic Table to determine the atomic number and atomic mass of common elements.	SC09-GR.HS-S.1-GLE.2-EO.c	Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table	
	SC09-GR.HS-S.1-GLE.4-EO.e	Predict the type of bonding that will occur among elements based on their position in the periodic table	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 2	The spatial configuration of atoms and the structure of the atoms in a molecule determine the chemical properties of the substance		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe that electrons are located in different energy levels in an atom and that the outer electrons determine its chemical properties.	SC09-GR.HS-S.1-GLE.2-EO.a	Develop, communicate, and justify an evidence-based scientific explanation supporting the current model of an atom	Concepts of electrons and chemical properties are implicit throughout SC09-GR.HS-S.1-GLE.2.
	SC09-GR.HS-S.1-GLE.2-EO.b	Gather, analyze and interpret data on chemical and physical properties of elements such as density, melting point, boiling point, and conductivity	
	SC09-GR.HS-S.1-GLE.2-EO.c	Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table	
	SC09-GR.HS-S.1-GLE.4-EO.d	Describe the role electrons play in atomic bonding	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 2	The spatial configuration of atoms and the structure of the atoms in a molecule determine the chemical properties of the substance		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Identify and describe that when two or more atoms chemically combine, they either share electrons (covalent bond, which can be polar or non-polar) or transfer electrons (ionic bond).	SC09-GR.HS-S.1-GLE.4	Atoms bond in different ways to form molecules and compounds that have definite properties	Concepts of atomic bonding are implicit throughout this GLE.
	SC09-GR.HS-S.1-GLE.4-EO.c	Use characteristic physical and chemical properties to develop predictions and supporting claims about compounds' classification as ionic, polar or covalent	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 3	There are observable and measurable physical and chemical properties that allow one to compare, contrast, and separate substances (for example: pH, melting point, conductivity, magnetic attraction)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Use information (e.g., pH, melting point, conductivity, magnetism, and reactivity) to classify, identify, and separate substances.	SC09-GR.7-S.1-GLE.1-EO.a	Identify properties of substances in a mixture that could be used to separate those substances from each other	
	SC09-GR.7-S.1-GLE.1-EO.b	Develop and design a scientific investigation to separate the components of a mixture	
	SC09-GR.HS-S.1-GLE.4-EO.b	Gather, analyze, and interpret data on chemical and physical properties of different compounds such as density, melting point, boiling point, pH, and conductivity	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 4	Word and chemical equations are used to relate observed changes in matter to its composition and structure (for example: conservation of matter)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Explain that a chemical equation shows how atoms are rearranged during a chemical change and translate word equations into chemical equations.	SC09-GR.HS-S.1-GLE.3-EO.a	Recognize, analyze, interpret, and balance chemical equations (synthesis, decomposition, combustion, and replacement) or nuclear equations (fusion and fission)	
	SC09-GR.HS-S.1-GLE.3-EO.b	Predict reactants and products for different types of chemical and nuclear reactions	
b. Determine whether the products and reactants of a chemical equation are balanced in order to show that matter is conserved.	SC09-GR.HS-S.1-GLE.3-EO.c	Predict and calculate the amount of products produced in a chemical reaction based on the amount of reactants	
	SC09-GR.HS-S.1-GLE.3-EO.d	Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate the conservation of mass and energy	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 5	Quantitative relationships involved with thermal energy can be identified, measured, calculated and analyzed (for example: heat transfer in a system involving mass, specific heat, and change in temperature of matter)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify whether chemical reactions are exothermic or endothermic.			This assessment objective is not explicit in the CAS but may still be assessed
b. Use measurements to determine the specific heat of a substance.	SC09-GR.HS-S.1-GLE.3	Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 6	Energy can be transferred through a variety of mechanisms and in any change some energy is lost as heat (for example: conduction, convection, radiation, motion, electricity, chemical bonding changes)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Compare and contrast conduction, convection, and radiation as ways that thermal energy can be transferred.	SC09-GR.HS-S.1-GLE.6-EO.c	Describe energy transformations both quantitatively and qualitatively	Although conduction and convection are not explicit in the CAS, these concepts may still be assessed.
b. Explain that in any transfer or transformation of energy, some of the energy is transformed into heat.	SC09-GR.8-S.1-GLE.2-N.2	Use tools to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations.	
	SC09-GR.HS-S.1-GLE.6-EO.a	Use direct and indirect evidence to develop and support claims about the conservation of energy in a variety of systems, including transformations to heat	
	SC09-GR.HS-S.1-GLE.6-EO.b	Evaluate the energy conversion efficiency of a variety of energy transformations	
	SC09-GR.HS-S.1-GLE.6-EO.c	Describe energy transformations both quantitatively and qualitatively	
	SC09-GR.HS-S.1-GLE.6-EO.e	Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate energy conservation and loss	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 7	Light and sound waves have distinct properties; frequency, wavelengths and amplitude		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Apply the terms frequency, wavelengths and amplitude to both sound (longitudinal) and light (transverse) waves.	SC09-GR.8-S.1-GLE.4-N.1	Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties	Concepts of wave properties are implicit throughout this GLE
	SC09-GR.8-S.1-GLE.4-EO.b	Describe for various waves the amplitude, frequency, wavelength, and speed	
b. Explain how frequency and wavelength are inversely related.	SC09-GR.8-S.1-GLE.4-N.1	Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 8	Quantities that demonstrate conservation of mass and conservation of energy in physical interactions can be measured and calculated		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Compare the total mass and total energy of all materials before and after a physical interaction.	SC09-GR.8-S.1-GLE.3-EO.c	Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change	
	SC09-GR.HS-S.1-GLE.3-EO.c	Predict and calculate the amount of products produced in a chemical reaction based on the amount of reactants	
	SC09-GR.HS-S.1-GLE.3-N.3	Use an inquiry approach to test predictions about chemical reactions.	

Standard 2	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)* Students know and can demonstrate understanding that:		
Benchmark 9	Newton's Three Laws of Motion explain the relationship between the forces acting on an object, the object's mass, and changes in its motion		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Apply Newton's First Law (inertia), Second Law (F=ma), and Third Law (action and reaction) to explain everyday situations through words and calculations.	SC09-GR.HS-S.1-GLE.1	Newton's laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion – but have limitations	
	SC09-GR.HS-S.1-GLE.1-EO.b	Develop, communicate and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force	
	SC09-GR.HS-S.1-GLE.1-EO.c	Develop, communicate and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 1	The pattern/process of reproduction and development is specific to different organisms		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify and describe different animal structures and behaviors that serve different functions in growth, survival and reproduction.	SC09-GR.7-S.2-GLE.1	Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment	Concepts of animal structures and behaviors are implicit throughout these GLEs.
	SC09-GR.8-S.2-GLE.2	Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation	
b. Compare advantages/ disadvantages of different types of reproduction/ development	SC09-GR.HS-S.2-GLE.2-EO.b	Describe or evaluate communities in terms of primary and secondary succession as they progress over time	Although the comparative advantages of different types of reproduction are not explicit in the CAS, these concepts may still be assessed.

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 2	There is a relationship between the processes of photosynthesis and cellular respiration (for example: in terms of energy and products)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe the process of photosynthesis.	SC09-GR.HS-S.2-GLE.4	The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun's light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.	Concepts of photosynthesis are implicit throughout this GLE. Some of this benchmark is covered in 7th grade "photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms."

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 2	There is a relationship between the processes of photosynthesis and cellular respiration (for example: in terms of energy and products)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Describe the process of cellular respiration.	SC09-GR.HS-S.2-GLE.4-EO.c	Explain how carbon compounds are gradually oxidized to provide energy in the form of adenosine triphosphate (ATP), which drives many chemical reactions in the cell	Some of this benchmark is covered in 7th grade "photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms."
	SC09-GR.HS-S.2-GLE.4-N.2	Critically evaluate models for photosynthesis and cellular respiration, and identify their strengths and weaknesses.	
c. Relate the processes of photosynthesis and cellular respiration.	SC09-GR.HS-S.2-GLE.4	The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun's light energy into the chemical energy of molecular bonds. Cellular respiration allows cells to utilize chemical energy when these bonds are broken.	Concepts of photosynthesis are implicit throughout this GLE.
	SC09-GR.HS-S.2-GLE.4-EO.a	Develop, communicate, and justify an evidence-based scientific explanation the optimal environment for photosynthetic activity	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 3	There is a purpose of synthesis and breakdown of macromolecules in an organism (for example: carbohydrates, lipids, amino acids serve as building blocks of proteins; carbon dioxide and water are the basic materials for building sugars through photosynthesis)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify the composition of biological molecules.	SC09-GR.HS-S.2-GLE.3-EO.a	Identify biomolecules and their precursors/building blocks	
	SC09-GR.HS-S.2-GLE.3-EO.b	Develop, communicate, and justify an evidence-based explanation that biomolecules follow the same rules of chemistry as any other molecule	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 3	There is a purpose of synthesis and breakdown of macromolecules in an organism (for example: carbohydrates, lipids, amino acids serve as building blocks of proteins; carbon dioxide and water are the basic materials for building sugars through photosynthesis)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Describe the function of macromolecules and why they are broken down.	SC09-GR.HS-S.2-GLE.3-EO.e	Analyze and interpret data on the body's utilization of carbohydrates, lipids, and proteins	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 4	Energy is used in the maintenance, repair, growth, and production of tissues		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Compare the energy requirements of an organism based on situational needs.	SC09-GR.HS-S.2-GLE.3-EO.c	Develop, communicate, and justify an evidence-based explanation regarding the optimal conditions required for enzyme activity	
	SC09-GR.HS-S.2-GLE.3-EO.d	Infer the consequences to organisms of suboptimal enzyme function – such as altered blood pH or high fever –using direct and indirect evidence	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 5	The human body functions in terms of interacting organ systems composed of specialized structures that maintain or restore health (for example: mechanisms involved in homeostasis [balance], such as feedback in the endocrine system)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe feedback mechanisms involved in maintaining homeostasis.	SC09-GR.HS-S.2-GLE.6-EO.b	Analyze and interpret data on homeostatic mechanisms using direct and indirect evidence to develop and support claims about the effectiveness of feedback loops to maintain homeostasis	
	SC09-GR.HS-S.2-GLE.6-EO.c	Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 5	The human body functions in terms of interacting organ systems composed of specialized structures that maintain or restore health (for example: mechanisms involved in homeostasis [balance], such as feedback in the endocrine system)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Identify the structure and function of the immune, endocrine and nervous systems.	SC09-GR.7-S.2-GLE.2	The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions	Although the functions and structures of the nervous and endocrine system are not explicit in the CAS, these concepts may continue to be assessed.
	SC09-GR.HS-S.2-GLE.6-EO.a	Discuss how two or more body systems interact to promote health for the whole organism	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 6	Changes in an ecosystem can affect biodiversity and biodiversity contributes to an ecosystem's dynamic equilibrium		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Predict what will happen to the biodiversity of an ecosystem if a change occurs in the ecosystem.	SC09-GR.6-S.2-GLE.1-EO.c	Develop, communicate, and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem	
	SC09-GR.HS-S.2-GLE.2-EO.a	Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem	
b. Explain community succession after a catastrophic event.	SC09-GR.HS-S.2-GLE.2-EO.b	Describe or evaluate communities in terms of primary and secondary succession as they progress over time	
c. Describe changes to biodiversity that could result from human actions in an ecosystem (For example, increases and/or decreases of organisms within a system).	SC09-GR.8-S.2-GLE.1	Human activities can deliberately or inadvertently alter ecosystems and their resiliency	Concepts of human impact on biodiversity are implicit throughout this GLE.
	SC09-GR.HS-S.2-GLE.2-EO.c	Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences	
	SC09-GR.HS-S.2-GLE.2-EO.d	Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactions	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 7	There is a cycling of matter (for example: carbon, nitrogen) and the movement and change of energy through the ecosystem (for example: some energy dissipates as heat as it is transferred through a food web)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Contrast the flow of energy with cycling of matter as they move through an ecosystem.	SC09-GR.HS-S.2-GLE.1	Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem	Concepts of energy flow through an ecosystem are implicit throughout this GLE.
	SC09-GR.HS-S.2-GLE.1-EO.f	Describe how carbon, nitrogen, phosphorus, and water cycles work	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 8	Certain properties of water sustain life (for example: polarity, cohesion, solubility)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Relate the polarity of water to its other properties.	SC09-GR.7-S.1-GLE.1	Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities	Concepts of properties of water are implicit throughout this GLE. Note that the CAS alignment for this assessment objective relates to physical science.
b. Given a biologic scenario, identify the property of water that allows that to occur.			Although not explicitly in the CAS at 10th grade or below, this assessment objective will continue to be assessed.

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 9	Cellular organelles have specific functions (for example: the relationship of ribosomes to protein, and the relationship of mitochondria to energy transformation)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe the function of cellular organelles.	SC09-GR.7-S.2-GLE.3-EO.a	Gather, analyze, and interpret data and models on the different types of cells, their structures, components and functions	
	SC09-GR.7-S.2-GLE.3-EO.b	Develop, communicate, and justify an evidence-based scientific explanation regarding cell structures, components, and their specific functions	
	SC09-GR.HS-S.2-GLE.5-EO.a	Analyze and interpret data to determine the energy requirements and/or rates of substance transport across cell membranes	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 10	Cell reproduction/division has various processes and purposes (mitosis, meiosis, binary fission)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Compare and contrast the purposes and processes of mitosis, meiosis, and binary fission.	SC09-GR.HS-S.2-GLE.7-EO.b	Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms	Comparing mitosis and meiosis is not explicit part of the CAS, but is fundamental to understanding DNA processes. This assessment objective will continue to be assessed.
	SC09-GR.HS-S.2-GLE.7-EO.d	Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 11	DNA has a general structure and function and a role in heredity and protein synthesis (for example: replication of DNA and the role of RNA in protein synthesis)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe the structure of DNA and the relationship among DNA, chromosomes and genes.	SC09-GR.HS-S.2-GLE.7-EO.a	Analyze and interpret data that genes are expressed portions of DNA	
	SC09-GR.HS-S.2-GLE.7-EO.b	Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms	
b. Describe the function of DNA in heredity.	SC09-GR.HS-S.2-GLE.7-EO.a	Analyze and interpret data that genes are expressed portions of DNA	
	SC09-GR.HS-S.2-GLE.7-EO.b	Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 12	Genes serve as the vehicle for genetic continuity and the source of genetic diversity upon which natural selection can act		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe and explain the basic process of DNA replication which allows for genetic continuity.	SC09-GR.HS-S.2-GLE.7	Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins	Concepts of using DNA replication for genetic continuity are implicit throughout this GLE.
b. Explain the significance of a mutation and its relationship to genetic diversity.	SC09-GR.HS-S.2-GLE.7-EO.d	Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations	
	SC09-GR.HS-S.2-GLE.7-EO.e	Explain using examples how genetic mutations can benefit, harm, or have neutral effects on an organism	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 13	Some traits can be inherited while others are due to the interaction of genes and the environment (for example: skin cancer triggered by over- exposure to sunlight or contact with chemical carcinogens)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Classify well-known conditions as being purely genetic or the result of the interaction of genes and the environment.	SC09-GR.HS-S.2-GLE.8-EO.d	Analyze and interpret data on medical problems using direct and indirect evidence in developing and supporting claims that genetic mutations and cancer are brought about by exposure to environmental toxins, radiation, or smoking	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 14	~~Organisms are classified into a hierarchy of groups and subgroups based on similarities which reflect their evolutionary relationships~~		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
~~a. Construct a classification system based on a variety of factors (for example, physical traits, DNA sequences).~~			Not explicitly in the CAS at 10th grade or below.

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 15	Mutation, natural selection, and reproductive isolation can lead to new species and affect biodiversity		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe how mutation, natural selection, and reproductive isolation can affect biodiversity.	SC09-GR.HS-S.2-GLE.9-EO.d	Analyze and interpret data on how evolution can be driven by three key components of natural selection – heritability, genetic variation, and differential survival and reproduction	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 16	An organism's adaptations (for example, structure, behavior) determine its niche (role) in the environment		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Predict the niche of an organism based on physical or behavioral characteristics.	SC09-GR.HS-S.2-GLE.2-EO.d	Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactions.	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 17	Variation within a population improves the chances that the species will survive under new environmental conditions		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. In new environmental conditions, predict how variation within a population will increase/decrease chances for survival.	SC09-GR.7-S.2-GLE.1	Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment	Concepts of how new environmental conditions impact survival are implicit throughout this GLE.
	SC09-GR.HS-S.2-GLE.9-EO.d	Analyze and interpret data on how evolution can be driven by three key components of natural selection – heritability, genetic variation, and differential survival and reproduction (possible replacement for 2.7.d)	

Standard 3	Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. *(Focus: Biology-- Anatomy, Physiology, Botany, Zoology, Ecology)* Students know and can demonstrate understanding that:		
Benchmark 18	Organisms change over time in terms of biological evolution and genetics		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Infer that organisms undergo biological evolution and genetic changes over time.	SC09-GR.HS-S.2-GLE.9	Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment	Concepts of biological evolution and genetic change are implicit throughout this GLE.

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 1	Earth's interior has a composition and structure		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe and label the layers of Earth.	SC09-GR.HS-S.3-GLE.3-EO.a	Develop, communicate, and justify an evidence-based scientific explanation about the theory of plate tectonics and how it can be used to understand geological, physical, and geographical features of Earth	Evidence of Earth's structure and composition is fundamental to understanding plate tectonics (SC09-GR.HS-S.3-GLE.3)
b. Evaluate and describe the evidence used to construct models of the composition of Earth's interior.	SC09-GR.HS-S.3-GLE.3-EO.a	Develop, communicate, and justify an evidence-based scientific explanation about the theory of plate tectonics and how it can be used to understand geological, physical, and geographical features of Earth	Evidence of Earth's structure and composition is fundamental to understanding plate tectonics (SC09-GR.HS-S.3-GLE.3)

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 2	The theory of plate tectonics helps to explain relationships among earthquakes, volcanoes, mid-ocean ridges, and deep-sea trenches		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Use evidence to explain the theory of plate tectonics and the inter-relationship between the plates, plate movement, and landforms.	SC09-GR.HS-S.3-GLE.3	The theory of plate tectonics helps explain geological, physical, and geographical features of Earth	Concepts of plate tectonics are implicit throughout this GLE.
	SC09-GR.HS-S.3-GLE.3-EO.a	Develop, communicate, and justify an evidence-based scientific explanation about the theory of plate tectonics and how it can be used to understand geological, physical, and geographical features of Earth	
	SC09-GR.HS-S.3-GLE.3-EO.b	Analyze and interpret data on plate tectonics and the geological, physical, and geographical features of Earth	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 3	The feasibility of predicting and controlling natural events can be evaluated (for example: earthquakes, floods, landslides)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe how modern scientists evaluate the risks associated with natural events and the attempt to control them.	SC09-GR.HS-S.3-GLE.5-EO.b	Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use	
	SC09-GR.HS-S.3-GLE.7	Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms	Concepts of evaluating risks of natural events are implicit throughout this GLE.
	SC09-GR.HS-S.3-GLE.7-EO.a	Develop, communicate, and justify an evidence-based scientific explanation regarding natural hazards, and explain their potential local and global impacts	
	SC09-GR.HS-S.3-GLE.7-EO.c	Make predictions and draw conclusions about the impact of natural hazards on human activity – locally and globally	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 4	There are costs, benefits, and consequences of natural resource exploration, development, and consumption (for example: geosphere, biosphere, hydrosphere, atmosphere and greenhouse gases)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Analyze data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use.	SC09-GR.HS-S.3-GLE.5-EO.d	Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 5	There are consequences for the use of renewable and nonrenewable resources		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Compare and contrast the uses of renewable and nonrenewable resources.	SC09-GR.6-S.3-GLE.3-EO.b	Identify and evaluate types and availability of renewable and nonrenewable resources	
	SC09-GR.HS-S.3-GLE.5-EO.a	Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources	
	SC09-GR.HS-S.3-GLE.5-EO.d	Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 6	Evidence is used (for example: fossils, rock layers, ice cores, radiometric dating) to investigate how Earth has changed or remained constant over short and long periods of time (for example: Mount St. Helen's eruption, Pangaea, and geologic time)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Recognize and interpret evidence in support of geologic theories of events.	SC09-GR.HS-S.3-GLE.1	The history of the universe, solar system and Earth can be inferred from evidence left from past events	Concepts of geologic theories are implicit throughout these GLEs.
	SC09-GR.HS-S.3-GLE.3	The theory of plate tectonics helps explain geological, physical, and geographical features of Earth	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 7	~~The atmosphere has a current structure and composition and has evolved over geologic time (for example: effects of volcanic activity and the change of life forms)~~		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. ~~Compare and contrast the layers of the atmosphere and their evolution.~~			Not explicitly in the CAS at 10th grade or below.

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 8	Energy transferred within the atmosphere influences weather (for example: the role of conduction, radiation, convection, and heat of condensation in clouds, precipitation, winds, storms)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe the resulting effects of energy transfer within the atmosphere.	SC09-GR.HS-S.3-GLE.4-EO.a	Develop, communicate, and justify an evidence-based scientific explanation that shows climate is a result of energy transfer among the atmosphere, hydrosphere, geosphere and biosphere	
	SC09-GR.HS-S.3-GLE.6-EO.a	Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the interaction of Earth's surface with water, air, gravity, and biological activity	
	SC09-GR.HS-S.3-GLE.6-EO.b	Analyze and interpret data, maps, and models concerning the direct and indirect evidence produced by physical and chemical changes that water, air, gravity, and biological activity create	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 9	Weather is caused by differential heating, the spin of Earth and changes in humidity (air pressure, wind patterns, coriolis effect)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify the effects of Earth's movement on wind and resulting weather.	SC09-GR.8-S.3-GLE.2	Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location	Concepts of Earth's movement affecting wind and weather are implicit throughout this GLE.
	SC09-GR.HS-S.3-GLE.4-EO.a	Develop, communicate, and justify an evidence-based scientific explanation that shows climate is a result of energy transfer among the atmosphere, hydrosphere, geosphere and biosphere	
	SC09-GR.HS-S.3-GLE.4-EO.c	Explain how a combination of factors such as Earth's tilt, seasons, geophysical location, proximity to oceans, landmass location, latitude, and elevation determine a location's climate	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 9	Weather is caused by differential heating, the spin of Earth and changes in humidity (air pressure, wind patterns, coriolis effect)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
Continued… a. Identify the effects of Earth's movement on wind and resulting weather.	SC09-GR.HS-S.3-GLE.4-EO.f	Interpret evidence from weather stations, buoys, satellites, radars, ice and ocean sediment cores, tree rings, cave deposits, native knowledge, and other sources in relation to climate change	
b. Explain weather caused by differential heating and changes in moisture.	SC09-GR.5-S.3-GLE.3	Weather conditions change because of the uneven heating of Earth's surface by the Sun's energy. Weather changes are measured by differences in temperature, air pressure, wind and water in the atmosphere and type of precipitation	Concepts of weather caused by differential heating and moisture are implicit throughout these GLEs.
	SC09-GR.8-S.3-GLE.1	Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the sun, and can be predicted and described through complex models	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 10	There are interrelationships between the circulation of oceans and weather and climate		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Predict the effects in ocean current changes on weather and climate.	SC09-GR.HS-S.3-GLE.4-EO.a	Develop, communicate, and justify an evidence-based scientific explanation that shows climate is a result of energy transfer among the atmosphere, hydrosphere, geosphere and biosphere	
	SC09-GR.HS-S.3-GLE.4-EO.c	Explain how a combination of factors such as Earth's tilt, seasons, geophysical location, proximity to oceans, landmass location, latitude, and elevation determine a location's climate	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 11	There are factors that may influence weather patterns and climate and their effects within ecosystems (for example: elevation, proximity to oceans, prevailing winds, fossil fuel burning, volcanic eruptions)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Analyze and interpret data of influential weather factors and their effects on climate and ecosystems.	SC09-GR.HS-S.3-GLE.7-EO.a	Develop, communicate, and justify an evidence-based scientific explanation regarding natural hazards, and explain their potential local and global impacts	
	SC09-GR.HS-S.3-GLE.7-EO.c	Make predictions and draw conclusions about the impact of natural hazards on human activity – locally and globally	
	SC09-GR.HS-S.3-GLE.4-EO.d	Identify mechanisms in the past and present that have changed Earth's climate	
	SC09-GR.HS-S.3-GLE.4-EO.e	Analyze the evidence and assumptions regarding climate change	
	SC09-GR.HS-S.3-GLE.4-EO.f	Interpret evidence from weather stations, buoys, satellites, radars, ice and ocean sediment cores, tree rings, cave deposits, native knowledge, and other sources in relation to climate change	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 12	Water and other Earth systems interact (for example: the biosphere, lithosphere, and atmosphere)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify and explain the interaction of water within all Earth systems, at both the global and regional levels.	SC09-GR.HS-S.3-GLE.6	The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes	Concepts of the interaction of water on Earth are implicit throughout this GLE.

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 13	Continental water resources are replenished and purified through the hydrologic cycle		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify and explain the natural factors within the hydrologic cycle that influence the quality and amount of water.	SC09-GR.6-S.3-GLE.2	Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere	Concepts of the hydrologic cycle are implicit throughout this GLE.
	SC09-GR.HS-S.3-GLE.6-EO.a	Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the interaction of Earth's surface with water, air, gravity, and biological activity	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 14	Gravity governs the motions observed in the Solar System and beyond		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Explain the role of gravity within the Solar System and major celestial bodies in the universe.	SC09-GR.HS-S.3-GLE.2-EO.a	Develop, communicate, and justify an evidence-based scientific explanation addressing questions around the extraterrestrial forces and energies that influence Earth	
	SC09-GR.HS-S.3-GLE.2-EO.b	Analyze and interpret data regarding extraterrestrial forces and energies	
	SC09-GR.HS-S.3-GLE.2-N.1	Understand the physical laws that govern Earth are the same physical laws that govern the rest of the universe.	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 15	There is electromagnetic radiation produced by the Sun and other stars (for example: X- ray, ultraviolet, visible light, infrared, radio)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Describe how electromagnetic radiation data is used in astronomy.	SC09-GR.HS-S.3-GLE.2-EO.a	Develop, communicate, and justify an evidence-based scientific explanation addressing questions around the extraterrestrial forces and energies that influence Earth	
	SC09-GR.HS-S.3-GLE.2-EO.b	Analyze and interpret data regarding extraterrestrial forces and energies	
	SC09-GR.HS-S.3-GLE.2-EO.c	Clearly identify assumptions behind conclusions regarding extraterrestrial forces and energies and provide feedback on the validity of alternative explanations	

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 16	Stars differ from each other in mass, color, temperature and age		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Classify stars based on their characteristics in a data table such as Hertzsprung-Russell diagram.	SC09-GR.8-S.3-GLE.3-EO.b	Describe methods and equipment used to explore the solar system and beyond	Although star classification is not explicit in the CAS, this concept may still be assessed.

Standard 4	Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)* Students know and can demonstrate understanding that:		
Benchmark 17	The scales of size and separation of components of the Solar System are complex		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Measure and interpret the size and separation of components of the Solar System.	SC09-GR.8-S.3-GLE.3-EO.a	Construct a scale model of the solar system, and use it to explain the motion of objects in the system such a planets, Sun, Moons, asteroids, comets, and dwarf planets	
	SC09-GR.8-S.3-GLE.3-EO.b	Describe methods and equipment used to explore the solar system and beyond	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 1	Print and visual media can be evaluated for scientific evidence, bias, or opinion		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify the strengths and weaknesses in published or presented scientific information (e.g., Are the results logical and supported by evidence? Was bias introduced? Was data shared and reviewed by peers? Were previous investigations on the same subject reviewed? Were there flaws in the research study? Etc.)	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Examine, evaluate, question, and ethically use information from a variety of sources and media Discuss the ethical and political issues Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims Analyze the evidence and assumptions Infer assumptions behind emotional, political, and data-driven conclusions	This objective is met in content-specific contexts within the CAS.
	SC09-GR.HS-S.2-GLE.2-N.1	Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims.	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 2	Identify reasons why consensus and peer review are essential to the scientific process.		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify reasons why consensus and peer review are essential to the scientific process.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others	This objective is met in content-specific contexts within the CAS.

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 3	Graphs, equations or other models are used to analyze systems involving change and constancy (for example: comparing the geologic time scale to shorter time frame, exponential growth, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Using graphs, equations, or other models, compare and contrast what changes and what remains constant within a system.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Gather, analyze and interpret data and create graphs	This objective is met in content-specific contexts within the CAS.
	SC09-GR.6-S.2-GLE.1-EO.c	Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the organisms, populations, and species within it such as the removal of a top predator or introduction of a new species	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 4	There are cause-effect relationships within systems (for example: the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify and describe cause-effect relationships between different components of a system.	SC09-GR.HS-S.2-GLE.2-EO.a	Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem	This objective is met in content-specific contexts within the CAS.
	SC09-GR.HS-S.2-GLE.2-EO.b	Describe or evaluate communities in terms of primary and secondary succession as they progress over time	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 4	There are cause-effect relationships within systems (for example: the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid)		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Predict the possible outcomes when one component of a system is changed.	SC09-GR.HS-S.2-GLE.1	Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem	
	SC09-GR.HS-S.2-GLE.2-EO.a	Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem	
	SC09-GR.HS-S.2-GLE.2-EO.b	Describe or evaluate communities in terms of primary and secondary succession as they progress over time	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 5	Scientific knowledge changes and accumulates over time; usually the changes that take place are small modifications of prior knowledge but major shifts in the scientific view of how the world works do occur		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Explain reasons why scientific knowledge changes over time.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Recognize that the current understanding has developed over time and become more sophisticated as new technologies have lead to new evidence	This objective is met in content-specific contexts within the CAS.

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 5	Scientific knowledge changes and accumulates over time; usually the changes that take place are small modifications of prior knowledge but major shifts in the scientific view of how the world works do occur		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
b. Identify examples of when new scientific evidence has dramatically changed previously accepted views in certain scientific fields (For example, Darwin, Galileo, Newton).	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Recognize that the current understanding has developed over time and become more sophisticated as new technologies have lead to new evidence	This objective is met in content-specific contexts within the CAS.

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 6	Interrelationships among science, technology and human activity lead to further discoveries that impact the world in positive and negative ways		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Analyze the effects of technology and human activity on the natural world and the progression of scientific knowledge.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Recognize that the current understanding has developed over time and become more sophisticated as new technologies have lead to new evidence	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 6	Interrelationships among science, technology and human activity lead to further discoveries that impact the world in positive and negative ways		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
Continued… a. Analyze the effects of technology and human activity on the natural world and the progression of scientific knowledge.	SC09-GR.HS-S.3-GLE.5-EO.a	Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources	
	SC09-GR.HS-S.3-GLE.5-N.1	Infer assumptions behind emotional, political, and data-driven conclusions about renewable and nonrenewable resource use.	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 7	There is a difference between a scientific theory and a scientific hypothesis		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
a. Identify examples of a scientific hypothesis, a scientific theory, and a scientific law.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Differentiate among the use of the terms "hypothesis," "theory," and "law" as they are defined and used in science compared to the usage of these terms in other disciplines or everyday use	This objective is met in content-specific contexts within the CAS.
b. Describe what distinguishes a scientific theory from a scientific law.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Differentiate among the use of the terms “hypothesis,” “theory,” and “law” as they are defined and used in science compared to the usage of these terms in other disciplines or everyday use.	

Standard 5	Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world. Students know and can demonstrate understanding that:		
Benchmark 7	There is a difference between a scientific theory and a scientific hypothesis		
Assessment Objective	**CAS Alignment Code**	**CAS Expectation Text**	**Comment**
c. Describe what distinguishes a scientific hypothesis from a scientific theory.	Expectations for students to understand the process of science is embedded throughout the Colorado Academic Standards and is not a standalone expectation. Examples of sentence stems from the Colorado Academic Standards that would relate to this framework objective are provided.	Differentiate among the use of the terms "hypothesis," "theory," and "law" as they are defined and used in science compared to the usage of these terms in other disciplines or everyday use.	

Note: Some assessment objectives or parts of assessment objectives are not contained within the Colorado Academic Standards at or below this grade level but will continue to be assessed with the TCAP in 10th grade. The concepts from these objectives are reflected in the table below.

Grade 10 Science	Relevant Assessment Objective(s)
Exothermic and endothermic chemical reactions	2.5.a
Conduction and convection	2.6.a
Comparative advantages of types of reproduction	3.1.b
Nervous and endocrine systems	3.5.b
Properties of water that allow life to occur	3.8.b
Meiosis and mitosis	3.10.a
Star Classifications	4.16.a