Alabama Comprehensive Assessment Program (ACAP)

Summative

Item Specifications

Science

Grade 6

Alabama Item Specifications

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Alabama Comprehensive Assessment Program (ACAP) *Summative*

The *Alabama Comprehensive Assessment Program* (ACAP) *Summative* item specifications are based on the development of summative assessments that measure the Alabama Course of Study Standards. The item specifications define the purpose of the *ACAP Summative* and provide important information regarding the content to be measured. The item specifications also serve as a road map to guide Alabama educators in the development and subsequent review of items that best measure the Course of Study Standards for a given grade and content area. Each content-area and grade-level item specification aligned to the given domain, cluster, and standard includes the following key information:

- Evidence statements
- Content limits/constraints
- Recommended Webb's Depth of Knowledge (DOK) or cognitive levels
- Item types for measuring a given standard
- Information regarding whether context is allowable
- Sample item stem information

The appendix to this document includes sample test items, along with information about the item, including item type, page reference, alignment, point value, depth of knowledge, and answer key. These sample items are provided to be an additional resource for educators to help guide instruction and assessment building in the classroom. Teachers can use the sample items as models when leading classroom discussion as well as creating items for classroom tests or quizzes. In each sample item, the level of rigor needed in the item in order to align with the content standard is evident.

Definitions

Course of Study Standards: The Course of Study Standards are a set of content curriculum statements that define what students should know and be able to do at a given grade level. The goal is to prepare students for future opportunities and options in the workplace and for everyday life. Through the implementation of the Alabama Course of Study: Science, students will be well equipped for the workforce upon graduation or be ready to pursue higher levels of education in Alabama's colleges and universities.

Domain: A domain is a group of related clusters and content standards. Sometimes standards from different domains may be closely related.

Subdomain: A subdomain is a smaller grouping of standards within the domain. For example, within the domain of Earth and Space Science are the subdomains of Earth's Place in the Universe, Earth's Systems, and Earth and Human Activity.

Standard: The standard defines what students should understand (know) and be able to do at the conclusion of a course or grade. The standard text in the item specification is preceded by a standard identifier (e.g., 4.PS.2) to indicate the student grade level as fourth (4), the domain as Physical Science (PS), and the standard number as two (2).

Evidence Statements: Evidence statements are closely aligned to the standard and do not deviate from the requirements of the standard. Standards that are substantial in content do provide for a better opportunity to "unpack the standard," which is the case for many of the Alabama Course of Study Standards. The evidence statements serve that purpose.

Assessment Limits/Content Constraints: Assessment limits and/or content constraints define the range of content knowledge and degree of difficulty that is allowable when items are written to measure a given standard.

Depth of Knowledge (DOK): Depth of knowledge involves the cognitive complexity or the nature of thinking required for a given item. Most recently, Webb's Depth of Knowledge levels are used in the development of items for cognitive demand. Therefore, when developing items for depth of knowledge, the item should be as demanding cognitively as what the actual standard expects. Webb's Depth of Knowledge includes four levels, from the lowest (basic recall) to the highest (extended thinking). The science *ACAP Summative* assessment items are written to one of three cognitive levels of complexity as follows:

- Level 1: Recall
- Level 2: Application of a Skill/Concept
- Level 3: Strategic Thinking

Item Types: The *ACAP Summative* assessments are composed of various item types. These item types are described in the following section.

Sample Stem Information: This statement explains what students are expected to do when they respond to a given item.

Item Types

The *Alabama Comprehensive Assessment Program* (ACAP) *Summative* assessments are composed of various item types. These item types are described below.

Multiple-Choice (MC) Items: MC items have four answer choices, including three distractors and one correct answer. Distractors for science represent common misconceptions, incorrect logic, incorrect understanding of scientific concepts and or principles, etc. A correct response to an MC item is worth one score point in the science *ACAP Summative*.

Multiple-Select (MS) Items: MS items are similar in structure to MC items. However, unlike an MC item, an MS item is composed of more than four options and more than one correct answer. In other words, multiple responses are required for a given item. For science, there are two types of MS configurations. One has five answer options, two of which are correct, and one has six answer options, two or three of which are correct. Directions for the number of options to select are provided with each item. A correct response to an MS item is worth one score point in the science *ACAP Summative*.

Short-Answer (SA) Items: SA items are constructed-response items that require a keyed response from the student. The number of characters is limited to a relatively small number in order to facilitate autoscoring. The types of characters allowed can also be limited to text only, numbers only, or a mix.

Technology-Enhanced (TE) Items: TE items share the same functional structure as traditional paper-and-pencil test items; however, the expansive features and functions of a computer-based medium allow for the incorporation of technical enhancements into traditional elements of a test item, such as the item stem, the stimulus (if any), the response area, or a combination of all three. These items require the use of one or more tools. In the science *ACAP Summative*, these item types are autoscored using scoring guidelines for the correct answer. TE items are worth one or two score points.

Science TE items include, but are not limited to, the following:

- **Drag-and-Drop Input:** These TE items provide a student with draggable entities that can be configured to be used once or multiple times.
- **Drop-Down List Input:** These TE items allow a student to select elements in drop-down lists that can be embedded within text or tables.
- **Hot Spot:** These TE items allow for an image to be highlighted or replaced with another image when selected by the student.
- **Text Highlight:** These TE items allow for designated text to be highlighted in a word, phrase, sentence, or paragraph.
- **Matching Table:** These TE items include a table with multiple rows and columns, and the student makes matches between the given elements in the rows and columns. The table can be customized to allow for only a single selection in a row or column or for multiple selections within each.
- **Bar Graph:** These TE items allow a student to adjust the bars of a graph up or down to identify specific values during the development of these items.

Item Specifications for Science

Item specifications are one of the key requirements for a high-quality, legally defensible, standards-based assessment. Item specifications help define important characteristics of the items (i.e., test questions) developed for each standard. These item specifications provide guidelines to help clarify the focus of what is to be assessed, what items may include, and what items may not include (i.e., assessment limits). Item specifications are used by item writers, item editors, and item reviewers as a common reference throughout the item-development process, from initial writing to final approval. These sample science item specifications are based on the Alabama Course of Study Standards.

Domain	ESS-Earth and Space Science
Subdomain	Earth's Place in the Universe
Standard	6.ESS.1: Create and manipulate models (e.g., physical, graphical, conceptual) to explain the occurrences of day/night cycles, length of year, seasons, tides, eclipses, and lunar phases based on patterns of the observed motions of celestial bodies.
Evidence Statements	The examinee will demonstrate an understanding of creating and manipulating models to explain the occurrences of day/night cycles, length of year, seasons, tides, eclipses, and lunar phases based on patterns of the observed motions of celestial bodies. The examinee will demonstrate the ability to describe relationships between components of models, including relationships such as • Earth rotating once on its axis each day; • the moon rotating once on its axis about each month; • the moon orbiting Earth once about each month; • the moon rotating once on its axis in the same amount of time it takes to orbit Earth; • the Earth-moon system orbiting the Sun once per year; • Earth's rotational axis being tilted, resulting in the most direct and more intense solar energy occurring in the Northern Hemisphere in the summer months and the least direct and less intense solar energy occurring during the winter months; • the visible part of the illuminated moon (as viewed from Earth) changing during a month as the location of the moon relative to Earth and the Sun changes; • whether an eclipse will occur given the relative locations of Earth, the Sun, and the moon; or the season at a location on Earth given the positions of Earth and the Sun.
Assessment Limits / Content Constraints	• Models can be physical, graphical, and/or conceptual.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Given the positions of Earth, the Sun, and the moon in the diagram, which prediction can best be made about the phase of the moon as observed from Earth on day X?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Place in the Universe
Standard	6.ESS.2: Construct models and use simulations (e.g., diagrams of the relationship between Earth and man-made satellites, rocket launches, International Space Station, elliptical orbits, black holes, life cycles of stars, orbital periods of objects within the solar system, astronomical units and light years) to explain the role of gravity in affecting the motions of celestial bodies (e.g., planets, moons, comets, asteroids, meteors) within galaxies and the solar system.
Evidence Statements	The examinee will demonstrate an understanding of constructing models and using simulations to explain the role of gravity in affecting the motions of celestial bodies within galaxies and the solar system. The examinee will demonstrate an understanding of the relationships between the components of the solar and galaxy systems and the role of gravity, including the following: • Gravity causes a pattern of smaller/less massive objects orbiting around larger/more massive objects. • The gravitational force of the Sun causes the planets and other celestial bodies to orbit around it, holding the solar system together. Possible models and simulations can include • diagrams of rocket launches, the relationship between Earth and man-made satellites, the International Space Station, elliptical orbits, black holes, life cycles of stars, orbital periods of objects within the solar system, and astronomical units and light-years. Celestial bodies may include • planets, moons, comets, asteroids, and meteors.
Assessment Limits / Content Constraints	• Assessment items should not require knowledge of Kepler's laws. • Assessment items should not require knowledge of the apparent retrograde motion of the planets as viewed from Earth. • Models can be physical or conceptual.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE

Sample Stem Information (as applicable)	Based on the model, which statement best predicts the effect on Earth's motions if the Sun did not have a gravitational force?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Place in the Universe
Standard	6.ESS.3: Develop and use models to determine scale properties of objects in the solar system (e.g., scale model representing sizes and distances of the Sun, Earth, moon system based on a one-meter diameter Sun).
Evidence Statements	The examinee will demonstrate an understanding of developing and using models to determine the scale properties of objects in the solar system. This understanding can be demonstrated by • using models to describe similarities and differences in patterns among solar system objects, including the distance from the Sun, diameter of the object, surface features, structure, and composition, or • using patterns in models to make conclusions about characteristics of categories of solar system objects (e.g., planets, moons, meteors, asteroids, comets) based on their features and location in the solar system.
Assessment Limits / Content Constraints	• Examinees should not be required to memorize or recall facts about the properties of planets and other solar system components. • Scale models should represent sizes and distances of objects in the solar system.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the model, which pattern is different for asteroids and planets?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.4: Construct explanations from geologic evidence (e.g., change or extinction of particular living organisms; field evidence or representations, including models of geologic cross-sections; sedimentary layering) to identify patterns of Earth's major historical events (e.g., formation of mountain chains and ocean basins, significant volcanic eruptions, fossilization, folding, faulting, igneous intrusion, erosion).
Evidence Statements	The examinee will demonstrate an understanding of constructing explanations from geological evidence to identify patterns of Earth's major historical events. Earth's major historical events may include • the formation of mountain chains and ocean basins, • significant volcanic eruptions, • fossilization, • folding, • faulting, • igneous intrusion, and • erosion. Geological evidence may include • the change or extinction of particular living organisms; • field evidence or representations, including models of geologic cross sections; and • sedimentary layering.
Assessment Limits / Content Constraints	• Assessment items should not require recall of names of specific periods or epochs or their associated events. • Rock strata and the fossil record should be used only to establish relative dates and not an absolute timescale.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the fossil record shown, which event in Earth's history most likely occurred most recently?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.5: Use evidence to explain how different geologic processes shape Earth's history over widely varying scales of space and time (e.g., chemical and physical erosion; tectonic plate processes; volcanic eruptions; meteor impacts; regional geographical features, including Alabama fault lines, Rickwood Caverns, and Wetumpka Impact Crater).
Evidence Statements	The examinee will show an understanding of using evidence to explain how different geological processes have shaped Earth's history over different scales of time and space. Spatial scales can range from very rapid catastrophic events (e.g., volcanoes, earthquakes, meteor impacts) to more slow and large-scale events (e.g., movement of Earth's plates, deposition of sediments). Geologic processes may include • chemical and physical erosion; • tectonic plate processes; • volcanic eruptions; • meteor impacts; and • regional geographical features, including Alabama fault lines, Rickwood Caverns, and the Wetumpka impact crater.
Assessment Limits / Content Constraints	• Evidence can be provided in the form of observations, data, diagrams, models, or text information. • Examinees should be provided with contextual information/details if regional geographic features are used. • Timescales should be general time frames and not absolute time spans.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on evidence from the diagrams, which statement best compares the timescales that would be used to measure physical erosion of a riverbank and a meteor impact on Earth?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.6: Provide evidence from data of the distribution of fossils and rocks, continental shapes, and seafloor structures to explain past plate motions.
Evidence Statements	The examinee will show an understanding of providing evidence from data of the distribution of fossils and rocks, continental shapes, and seafloor structures to explain past plate motions by • identifying that regions on different continents that share similar fossils and rocks suggest that in the past, those sections of continent were once attached and have since separated; • explaining that the puzzle-like fit of the continent shapes suggest that those landmasses were once joined and have since separated; or • explaining that the distribution of seafloor structures and the patterns of ages of rocks on the seafloor support the interpretation that new crust forms at the ridges and moves away from the ridges as new crust continues to form and that the old crust is being destroyed at the seafloor trenches.
Assessment Limits / Content Constraints	• Assessment items should not assess paleomagnetic anomalies in oceanic and continental crust.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Which inference about the continents shown is best supported by the fossil evidence in the drawing?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.7: Use models to construct explanations of the various biogeochemical cycles of Earth (e.g., water, carbon, nitrogen) and the flow of energy that drives these processes.
Evidence Statements	The examinee will demonstrate an understanding of using models to construct explanations of the biogeochemical cycles on Earth and the flow of energy that drives these processes by • using models to explain that energy from the Sun causes water to move throughout various phases of the water cycle; • using models to explain that energy from the Sun allows plants to consume water and carbon dioxide, resulting in the production of oxygen and glucose; or • using models to explain that nitrogen gas in the atmosphere moves into the soil and then into plants, that the nitrogen is converted into a new form and animals eat the plants, moving the nitrogen compounds into their system, and that when the animal eventually dies, decomposers break down its body and the nitrogen compounds in its body are returned to the soil to be used again.
Assessment Limits / Content Constraints	• The biogeochemical processes assessed may include the water cycle, carbon cycle, and nitrogen cycle. • Examinees should not be required to know the biochemical steps of photosynthesis. • Examinees should not be required to know all the conversions of various nitrogen compounds that occur during the nitrogen cycle.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Which model best shows how energy plays a role in moving water through the system shown? Drag and drop the drawings into the boxes below to make a model of how nitrogen moves through this ecosystem.

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.8: Plan and carry out investigations that demonstrate the chemical and physical processes that form rocks and cycle Earth's materials (e.g., processes of crystallization, heating and cooling, weathering, deformation, and sedimentation).
Evidence Statements	The examinee will demonstrate an understanding of planning and carrying out investigations that demonstrate the chemical and physical processes that form rocks and cycle Earth's materials by • explaining that Earth processes cause matter to cycle through observable chemical and physical changes; • identifying that the movement of energy from Earth's hot interior causes the cycling of matter through melting, crystallization, and deformation; • explaining that energy flowing from the Sun causes matter to cycle through processes that produce weathering, erosion, and sedimentation; or • explaining that energy from the Sun and Earth's interior can change a rock into a new rock type over time. The chemical and physical processes may include crystallization, heating and cooling, weathering, deformation, and sedimentation.
Assessment Limits / Content Constraints	Examinees should not be required to identify and name specific minerals.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Which step could be added to the investigation procedure to help show a physical process that breaks rocks into smaller pieces? Drag and drop the investigation steps into the correct order to show a procedure that would help model melting and crystallization.

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.9: Use models to explain how the flow of Earth's internal energy drives a cycling of matter between Earth's surface and deep interior causing plate movements (e.g., mid-ocean ridges, ocean trenches, volcanoes, earthquakes, mountains, rift valleys, volcanic islands).
Evidence Statements	The examinee will demonstrate an understanding of using models to explain how the flow of Earth's internal energy drives a cycling of matter between Earth's surface and deep interior, causing plate movements, by • explaining that energy from Earth's core flows through matter to Earth's surface and results in the movement of tectonic plates or • explaining that the motion of Earth's plates causes changes that result in large-scale features on Earth's surface, including mid-ocean ridges, ocean trenches, volcanoes, earthquakes, mountains, rift valleys, and volcanic islands.
Assessment Limits / Content Constraints	• Examinees should be required only to show a basic understanding of the mechanism (convection) by which energy from Earth's core is moved to Earth's surface to result in plate motion.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Drag and drop the arrows into the model to show how energy flows to result in plate movement. Based on the model, which large-scale Earth feature would most likely form as a result of the plate movement shown?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.10: Use research-based evidence to propose a scientific explanation regarding how the distribution of Earth's resources such as minerals, fossil fuels, and groundwater are the result of ongoing geoscience processes (e.g., past volcanic and hydrothermal activity, burial of organic sediments, active weathering of rock).
Evidence Statements	The examinee will demonstrate an understanding of using research-based evidence to propose an explanation about how the distribution of Earth's resources, such as minerals, fossil fuels, and groundwater, are the result of ongoing geoscience processes by • explaining that as resources are used, they are mainly replenished by geologic processes; • identifying that resources are limited and nonrenewable in some cases due to the long amounts of time needed for some resources to form; • identifying evidence from past and current geologic processes that have resulted in various resources in specific locations on Earth; or • examining and describing the ways that humans change how much of a resource is on Earth and where some resources can be located on Earth. Ongoing geoscience/geologic processes can include past volcanic and hydrothermal activity, the burial of organic sediments, and active weathering of rock.
Assessment Limits / Content Constraints	Research-based evidence should be provided for the student in the prompt materials.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the evidence provided, which statement best explains the difference in groundwater supply in the two locations described?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.11: Develop and use models of Earth's interior composition to illustrate the resulting magnetic field (e.g., magnetic poles) and to explain its measurable effects (e.g., protection from cosmic radiation).
Evidence Statements	The examinee will demonstrate an understanding of developing and using models of Earth's interior composition to illustrate its resulting magnetic fields and to explain the measurable effects of these fields. Using models, the examinee will demonstrate an understanding of one or more of the following concepts: • Earth is composed of layers: a thin outer crust, a mantle, and an outer core and inner core. The core is made mostly of iron, which is a good conductor. • The iron conductor in the core along with the energy provided by the convective motion of the outer core and Earth's rotation provide the conditions needed to produce a magnetic field. • Earth's magnetic field results in two poles, the geomagnetic North and South Poles. • Earth's magnetic field serves to deflect most solar wind. If not deflected, the charged particles of the solar wind would strip away the ozone layer. The ozone layer protects Earth from harmful ultraviolet (UV) radiation.
Assessment Limits / Content Constraints	• Examinees should not be required to explain the mechanism of how Earth's magnetic field deflects solar wind. • Examinees should not be required to explain the mechanism of how solar wind could negatively impact Earth's ozone layer.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Drag and drop the labels into the model of Earth's cross section to identify each layer and its magnetic poles. Use the drop-down menus to complete the statement about the relationship shown in the model between Earth's magnetic field and how it protects Earth.

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.12: Integrate qualitative scientific and technical information (e.g., weather maps; diagrams; other visualizations, including radar and computer simulations) to support the claim that motions and complex interactions of air masses result in changes in weather conditions.
Evidence Statements	The examinee will demonstrate an understanding of integrating scientific and technical information to support the claim that motions and complex interactions of air masses result in changes in weather conditions. The examinee will demonstrate an understanding of the principle that air masses flow from regions of high pressure to low pressure, causing weather. Additionally, sudden changes in weather can result when different types of air masses collide. Technical information could include • weather maps; • diagrams; and • other visualizations, including radar and computer simulations. The examinee will demonstrate an understanding of how to use various instruments to monitor local weather and examine weather patterns to predict weather events, especially the impact of severe weather. Scientific instruments used to make measurements could include • thermometers, • barometers, and • anemometers. Severe weather could include • fronts, • hurricanes, • tornadoes, • blizzards, • ice storms, and • droughts.

Assessment Limits / Content Constraints	• Examinees should not be required to recall names of cloud types. • Examinees should not be required to memorize weather symbols used in weather maps.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the weather map and the barometer readings, which relationship can best be identified between changes in pressure and strong weather events?

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.13: Use models (e.g., diagrams, maps, globes, digital representations) to explain how the rotation of Earth and unequal heating of its surface create patterns of atmospheric and oceanic circulation that determine regional climates.
Evidence Statements	The examinee will demonstrate an understanding of using models to explain how the rotation of Earth and unequal heating of its surface create patterns of atmospheric and oceanic circulation that determine regional climates. The examinee will demonstrate this understanding by • using models to explain how patterns of heating on Earth vary by latitude, altitude, and geographic land distribution due to differences in the distribution of solar energy and temperature changes; • using models to show that air and water flow from higher density to lower density (temperature or salinity); • using models to show that higher average temperatures occur near the equator and lower average temperatures occur away from the equator due to patterns in direct versus indirect sunlight; • using models to show that oceans have less significant changes in temperature than land, which leads to differences in inland and coastal climate patterns; • using models to show that Earth's rotation causes oceanic and atmospheric flows to curve when viewed from Earth's rotating surface and that landforms provide a boundary that control where ocean currents can flow; or • using models to show that ocean circulation results in a transfer of heat worldwide as a result of the global ocean convection cycle. Models can include • diagrams, • maps, • globes, and • digital representations. The examinee could demonstrate how to use experiments to investigate how energy from the Sun is distributed between Earth's surface and its atmosphere by convection and radiation.

	Investigation Examples warmer water in a pan rising as cooler water sinks; warming one's hands by a campfire
Assessment Limits / Content Constraints	Examinees should not be required to show an understanding of the dynamics of the Coriolis effect.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Drag and drop the labels into the models to show which part of Earth is receiving more direct sunlight during the summer and winter seasons in Alabama.

Domain	ESS-Earth and Space Science
Subdomain	Earth's Systems
Standard	6.ESS.14: Analyze and interpret data (e.g., tables, graphs, maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; rates of human activities) to describe how various human activities (e.g., use of fossil fuels, creation of urban heat islands, agricultural practices) and natural processes (e.g., solar radiation, greenhouse effect, volcanic activity) may cause changes in local and global temperatures over time.
Evidence Statements	The examinee will demonstrate an understanding of analyzing and interpreting data to describe how various human activities and natural processes may cause changes in local and global temperatures over time. Types of data could include • tables, • graphs, • maps of global and regional temperatures, • atmospheric levels of gases such as carbon dioxide and methane, and • rates of human activities. Examples of human activities could include • use of fossil fuels, • creation of urban heat islands, and • agricultural practices. Examples of natural processes could include • solar radiation, • the greenhouse effect, and • volcanic activity.
Assessment Limits / Content Constraints	• Examinees should be provided with all the data needed to demonstrate understanding.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the data in the table, how does clearing many fields for farming most likely affect the local temperatures in the nearby area?

Domain	ESS-Earth and Space Science
Subdomain	Earth and Human Activity
Standard	6.ESS.15: Analyze evidence (e.g., databases on human populations, rates of consumption of food and other natural resources) to explain how changes in human population, per capita consumption of natural resources, and other human activities (e.g., land use, resource development, water and air pollution, urbanization) affect Earth's systems.
Evidence Statements	The examinee will demonstrate an understanding of analyzing evidence to explain how changes in human populations and their use of resources affect Earth's systems. The examinee will demonstrate an understanding of the impacts of humans on the appearance, composition, and structures of Earth's systems and the rates of these changes. Evidence could include • databases on human populations and • rates of consumption of food and other natural resources. Human activities could include • land use, • resource development, • water and air pollution, and • urbanization.
Assessment Limits / Content Constraints	• Examinees should be provided with evidence needed for analysis.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Based on the graph showing the rate of human use of water, which conclusion can best be made about the effects of future human population growth on the water supply?

Domain	ESS-Earth and Space Science
Subdomain	Earth and Human Activity
Standard	6.ESS.16: Implement scientific principles to design processes for monitoring and minimizing human impact on the environment (e.g., water usage, including withdrawal of water from streams and aquifers or construction of dams and levees; land usage, including urban development, agriculture, or removal of wetlands; pollution of air, water, and land).*
Evidence Statements	The examinee will demonstrate an understanding of implementing scientific principles to design processes for monitoring and minimizing human impacts on the environment. Examples of human impacts on the environment to target include • water usage, including the withdrawal of water from streams and aquifers or the construction of dams and levees; • land usage, including urban development, agriculture, or the removal of wetlands; and • the pollution of air, water, and/or land. The examinee may also address how various solutions meet specific constraints, such as cost, time needed to make the solution, and the cost and/or time involved in maintaining the solution. Additionally, the examinee may address the limitations of the solution and whether the solution positively or negatively impacts other parts of the ecosystem.
Assessment Limits / Content Constraints	• Examinees should make a direct connection between the solution and how it monitors and/or minimizes a specific human impact on the environment.
DOK(s)	2 or 3
Item Type(s)	MC, MS, SA, TE
Sample Stem Information (as applicable)	Which solution described in the table would best meet the needs of reducing water pollution in a local stream while also keeping the cost as low as possible?

Appendix A: Sample Items

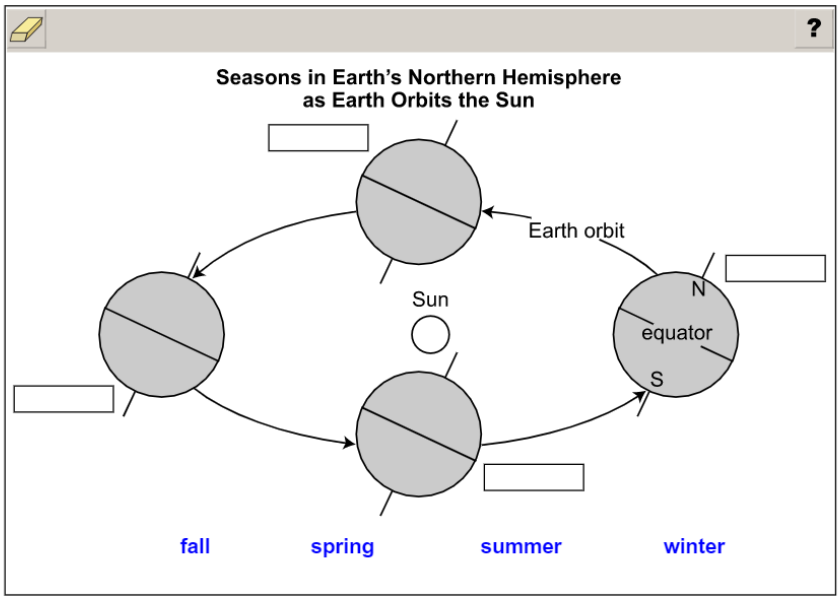
Sample Items

Appendix A: Sample Items

Sample Item 1

A student draws a model of Earth's orbit around the Sun to demonstrate seasonal changes in the Northern Hemisphere.

Drag the name of each season into the correct box to complete the model.



Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	Top box moving counterclockwise: spring, summer, fall, winter
Page Reference	7	
Alignment	ESS.1	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 2

The data table lists information about the planets in our solar system.

Planet Information

Planet	Mass (10^{24} kg)	Gravity (m/s^2)	Orbital Period (days)
Mercury	0.330	3.7	88.0
Venus	4.87	8.9	224.7
Earth	5.97	9.8	365.2
Mars	0.642	3.7	687.0
Jupiter	1,898	23.1	4,331
Saturn	568	9.0	10,747
Uranus	86.8	8.7	30,589
Neptune	102	11.0	59,800

Based on the data, select the **two** statements that **best** describe the planets in our solar system.

(a) Planets farther from the Sun revolve faster than planets closer to the Sun.

(b) The orbital period of a planet determines the gravitational pull of that planet.

(c) Planets farther from the Sun take longer to orbit the Sun than planets closer to the Sun.

(d) The mass of a planet is the only factor that determines the Sun's gravitational pull on that planet.

(e) Planets closer to the center of the solar system have greater masses than planets farther from the Sun.

(f) The mass of a planet and its distance from the Sun determine the Sun's gravitational pull on that planet.

Item Information		Answer Key(s) Description
Item Type	Multiple Select	C, F
Page Reference	8	
Alignment	ESS.2	
Point Value	1	
Depth of Knowledge	3	
Answer Key	(see description)	

Appendix A: Sample Items

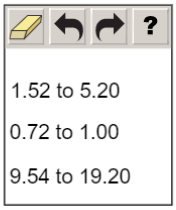
Sample Item 3

A student is building a scale model of the solar system. The table below shows the distance between the Sun and each planet in our solar system. In the student's model, one astronomical unit (AU) is equal to one meter.

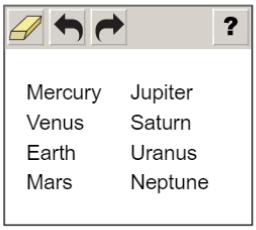
Scaled Distance of Objects in the Solar System

Planet	Distance from Sun (AU is equal to one meter)
Mercury	0.39
Venus	0.72
Earth	1.00
Mars	1.52
Jupiter	5.20
Saturn	9.54
Uranus	19.20
Neptune	30.10

Part A: The asteroid belt in our solar system is between the inner and the outer planets. Select the range of meters from the Sun in which the asteroid belt is located in the student's model.



Part B: Select the names of the **two** planets that are closest together in the student's scale model.



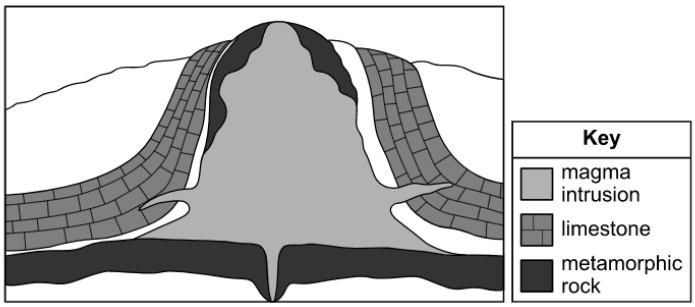
Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	Part A: 1.52 to 5.20 Part B: Venus and Earth
Page Reference	10	
Alignment	ESS.3	
Point Value	2	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 4

The diagram represents the geologic profile of an area.

Geologic Profile



Which statement **best** describes the formation of rock in this geologic profile area?

(a) The magma intrusion occurred before the deposition of the limestone on both sides of the intrusion.

(b) The rock beneath the magma intrusion formed when multiple layers of sediment were deposited over time.

(c) The limestone formed when the heat from the magma intrusion partially melted existing rock, changing its properties.

(d) The rock in the area has undergone changes from the heat of the magma intrusion and the pressure from surrounding rock layers.

Item Information	
Item Type	Multiple Choice
Page Reference	11
Alignment	ESS.4
Point Value	1
Depth of Knowledge	3
Answer Key	D

Appendix A: Sample Items

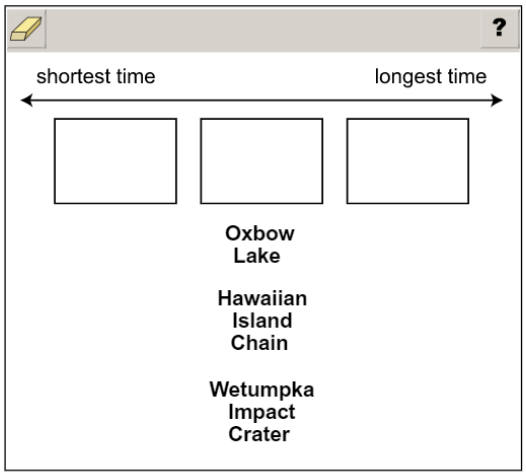
Sample Item 5

The table provides some information about how some Earth features formed.

Landform Formation

Feature	Method of Formation
Hawaiian Island Chain	Magma moved up through a vent in Earth's crust, forming islands. As the tectonic plate moved, the formed islands moved away from the vent and new islands formed.
Oxbow Lake	Erosion by flowing water carved out a curve in a river. The curve became so large that the river stopped flowing through the curve and created a different, shorter channel to flow through. Sediment separated the curve from the river, making it into a lake.
Wetumpka Impact Crater	An asteroid collided with Earth's surface and vaporized, creating an explosion.

Drag the names of the features into the diagram to compare the amount of time each feature took to form.



Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	Left to Right: Wetumpka Impact Crater, Oxbow Lake, Hawaiian Island Chain
Page Reference	12	
Alignment	ESS.5	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 6

Many scientists theorize that the continents were once joined together. Select the **two** pieces of evidence that scientists use to support this theory.

(a) Mountain ranges are present on all continents.

(b) The shape of the continents appear to fit together.

(c) The size of each continent has increased over time.

(d) The continents have been reshaped by weathering and erosion.

(e) Fossils of the same species have been discovered on different continents.

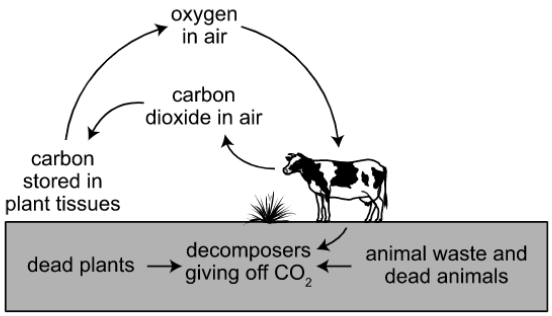
Item Information		Answer Key(s) Description
Item Type	Multiple Select	B, E
Page Reference	13	
Alignment	ESS.6	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 7

Biochemical cycles, such as the carbon cycle, affect the flow of energy on Earth.

Carbon Cycle



Based on the diagram, what role do animal waste and dead animals play in providing energy in this cycle?

(a) They provide energy for plants.

(b) They provide energy for the soil.

(c) They provide energy to the decomposers.

(d) They provide energy back to the atmosphere.

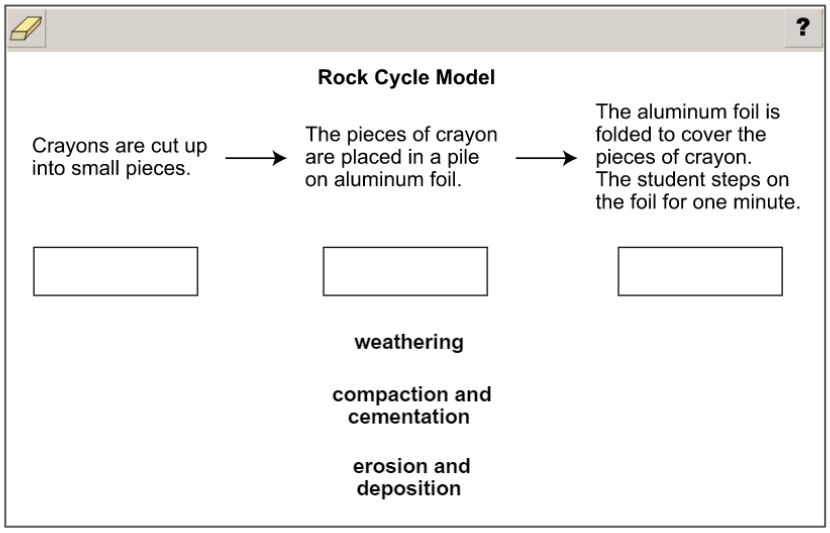
Item Information	
Item Type	Multiple Choice
Page Reference	14
Alignment	ESS.7
Point Value	1
Depth of Knowledge	2
Answer Key	C

Appendix A: Sample Items

Sample Item 8

A student uses crayons to model processes in the rock cycle.

Drag the process represented by each step into the model.



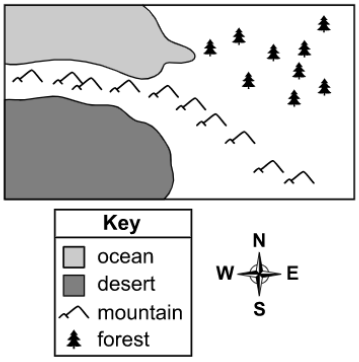
Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	Left to Right: weathering, erosion and deposition, compaction and cementation
Page Reference	15	
Alignment	ESS.8	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 9

Coal forms over time from the remains of plants. Oil forms from the remains of tiny organisms that live in salt water. The map shows some of the geologic features in an area many years ago.

Geologic Features in an Area Many Years Ago



Based on the information in the map, use the drop-down menus to predict where coal and oil would **most likely** be found in this location at the present time.

Coal would be found in the [ ], and oil would be found in the [ ].

northeast	northeast
northwest	northwest
southeast	southeast
southwest	southwest

Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	northeast, northwest
Page Reference	17	
Alignment	ESS.10	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 10

A student wants to develop a model to illustrate how Earth's magnetic field is produced. Which pair of statements describes characteristics that the student must include in the model?

(a) The model should show Earth's interior layers. The outer core should be liquid metal and able to move.

(b) The model should show Earth's interior layers. The solid, outermost layer should be made of several different pieces.

(c) The model should show the moon's orbit around Earth. An arrow should show the direction the moon pulls on Earth's oceans.

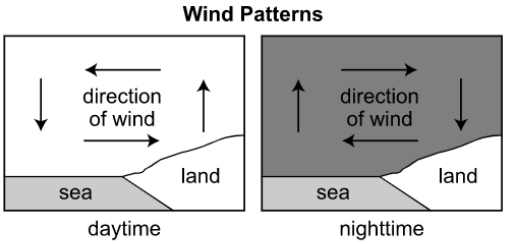
(d) The model should show the moon's orbit around Earth. An arrow showing Earth's gravitational pull on the moon should point from the moon to Earth.

Item Information	
Item Type	Multiple Choice
Page Reference	18
Alignment	ESS.11
Point Value	1
Depth of Knowledge	2
Answer Key	A

Appendix A: Sample Items

Sample Item 11

The model shows how wind patterns near the sea change between daytime and nighttime.



What is the **most likely** factor that causes the change in these wind patterns?

(a) Seawater can hold more energy than fresh water during the daytime.

(b) Air above land heats up and cools off more quickly than air above water.

(c) The lack of sunlight during nighttime causes air to cool and sink over the water.

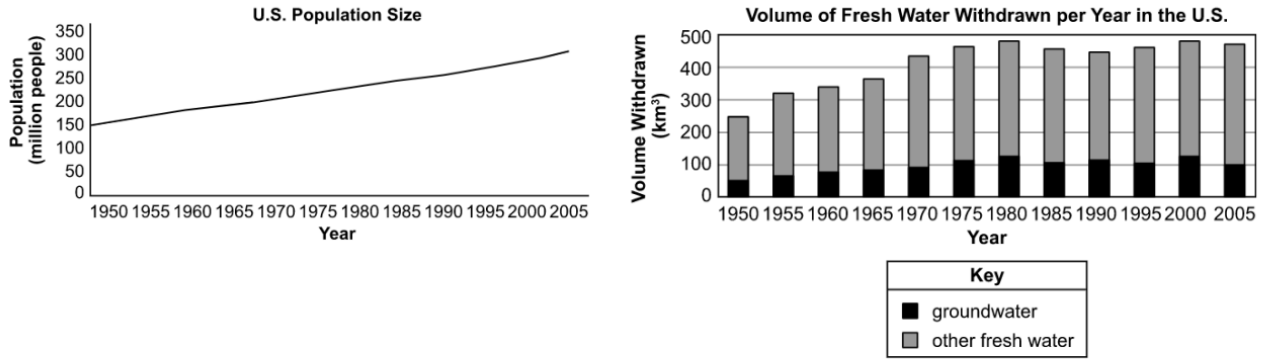
(d) The shape of the land is constantly being changed by the motion of the seawater.

Item Information	
Item Type	Multiple Choice
Page Reference	21
Alignment	ESS.13
Point Value	1
Depth of Knowledge	2
Answer Key	B

Appendix A: Sample Items

Sample Item 12

The two graphs below show the population growth and the usage of fresh water in the United States.



Use the drop-down menus to correctly complete the analysis of the graphs.

After 1980, the volume of groundwater and other fresh water withdrawn [▾] as the U.S. population [▾]. This means that water use became [▾] efficient after 1980.

increased	more	increased
decreased	less	leveled

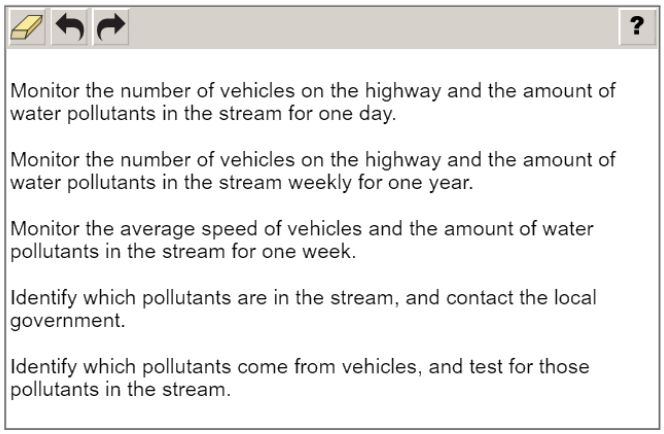
Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	leveled, increased, more
Page Reference	24	
Alignment	ESS.15	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	

Appendix A: Sample Items

Sample Item 13

A highway in northern Alabama has had increased vehicle traffic. Reductions in organism populations have been observed in a nearby stream.

Select the **two** methods that would be **most** useful for a scientist who wants to study how the highway traffic can affect the stream.



Item Information		Answer Key(s) Description
Item Type	Technology Enhanced	methods 2 and 5
Page Reference	26	
Alignment	ESS.16	
Point Value	1	
Depth of Knowledge	2	
Answer Key	(see description)	