Earth and Space Science Framework K-12

(NGSS in Parentheses)

Kindergarten								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
K	The Universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What are the predictable patterns caused by different objects in the solar system? How do objects in the universe appear and behave?	N/A	N/A	N/A	N/A	N/A	N/A
K	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. (ESS2.D)	Use and share observations of local weather conditions to describe patterns over time. (K-ESS2-1)	Sunny Changes Cloudy Cold Cool Describe Foggy Hot Observe Partly Cloudy Patterns Predict Rainy Snowy Warm Weather Windy	3.1.4.C 3.2.4.B 3.4.4.D 3.5.4.C	3.3.3.A5 3.3.4.A5	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3 S4.A.3.3.1
K	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of	How and why is Earth constantly changing?	Sunlight warms the Earth's surface. (PS3.B)	Make observations to determine the effect of sunlight on the Earth's surface. (K-PS3-1)	Changes Describe Earth Surface Sunlight Observe Predict	3.4.4.B 3.5.4.C	3.2.3.B3	S4.A.1.3 S4.A.2.1 S4.A.3.3 S4.D.2.1

	temporal and spatial scales.							
K	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Sunlight warms the Earth's surface. (PS3.B)	Use tools and materials to design and build a structure that will reduce (or increase) the warming effect of sunlight on an area. (K-PS3-2)	Build Canopy Cool Materials Structure Sunlight Tent Tools Umbrella Warming effect	3.4.4.B 3.5.4.C		S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.3 S4.B.2.1 S4.B.3.2 S4.D.2.1
K	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (ESS3.B)	Ask questions to obtain information about the purpose of weather forecasting to prepare for and respond to weather. (K-ESS3-2)	Conditions Design Evaluate Hazard Natural Natural hazard Process Region Solution Weather	3.2.4.C 3.8.4.A	3.3.3.A5 3.3.4.A5	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
K	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is the Earth constantly changing?	Plants and animals can change their environment. (ESS2.E)	Use evidence to show how plants and animals are able to change their environment to meet their needs. (K-ESS2-2)	Needs	3.2.4.C	4.1.1.A 4.1.K.D 4.6.4.A 4.8.4.C	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
K	The Earth's surface processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	People can make choices to reduce impact on the environment. (ESS3.C)	Describe ways to reduce impact of humans on the land, water, and air. (K-ESS3-3)	Air Choices Impact Land Water	4.8.4.C	4.5.K.D 4.5.2.C	S.4.B.3.2 S.4.B.3.3

K	The Earth's surface processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Things that people do to live can affect the world around them. (ESS3.C)	Describe and communicate solutions to reduce impact of humans on land, water, water, and air. (K-ESS2-2)	Recycle Reduce Reuse Solutions	4.8.4.C 3.2.4.D 3.8.4.C 3.8.4.A	4.5.PK.D 4.5.3.D	S.4.B.3.2 S.4.B.3.3
K	The Earth's surface processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Living things need water, air, and resources from the land. Organisms live in places that have the things they need. (ESS3.A)	Using evidence, state an argument how plants and animals can change the environment to meet their needs. (K-ESS3-1)	Argument Evidence	3.2.4.C 4.6.4.A	4.1.3.D 4.5.K.E	S.4.A.11 S.4.B.3.2 S.4.B.3.3
First Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Observable changes and patterns in the sky are caused by motions in the Earth-moon-sun system. (ESS1.A)	Use observations of stars, moon, and sun in the day and night sky to describe patterns that can be predicted. (1-ESS1-1)	Changes Describe Moon Observe Pattern Predict Star Sun System	3.4.4.D 3.1.4.C 3.1.4.A 3.1.7.A 3.2.4.A 3.2.4.B 3.2.4.C	3.3.2.B1 3.3.4.B1 3.3.4.B2 3.3.PK.B.1	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3 S4.D.3.1.1 S4.D.3.1.2
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	The motion of the sun, moon and earth relates to time. (days, months, years). (ESS1.B)	Use observations to compare the motion of the sun, earth and moon as it relates to time. (1-ESS1-1)	Earth Moon Motion Sun	3.1.4.C 3.2.4.B 3.4.4.D	3.3.2.B1 3.3.3.B1	S.4.A.1.3.1 S4.D.3.1.2
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted	What is the universe, and what is Earth's place in it?	Observable changes and patterns in the sky are caused by motions in the Earth-moon-sun system. (ESS1.A)	Observe and describe patterns of objects in the sky that are cyclic and can be predicted. (1-ESS1-2)	Patterns	3.4.4.D 3.1.4.C 3.1.4.A 3.1.7.A 3.2.4.A 3.2.4.B	3.3.2.B1 3.3.4.B2 3.3.3.B1 3.3.3.B3	S4.A.3.3.1 S4.A.3.3.2

	physical processes and laws.					3.2.4.C		
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Patterns of the motion of the sun, moon and stars in the sky can be observed, described and predicted. (ESS1.A)	Observe, describe, and predict patterns of daily change in the appearance and visibility of the moon and sun. (1-ESS1-2)	Predict Sky Sunrise Sunset	3.4.4.D 3.1.4.C 3.1.4.A 3.1.7.A 3.2.4.A 3.2.4.B 3.2.4.C	3.3.3.B1 3.3.4.B2	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3 S4.D.3.1.1 S4.D.3.1.2 S4.D.3.1.3
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Seasonal patterns of sunrise and set can be observed, described and predicted. (ESS1.B)	Observe, describe, and predict patterns of seasonal change in the timing and position of sunrise and sunset. (1-ESS1-2)	Sunrise Sunset	3.2.4.B	3.3.2.B1	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.D.3.1.1 S.4.D.3.1.2
1	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Through the use of tools and or media objects can be observed more clearly than with the naked eye.	Use scientific tools such as binoculars or telescopes to enhance observations.	Binocular Telescope Tools		3.3.4.B1 3.3.4.B2	S4.A.1.1 S4.A.1.3 S4.A.1.3.1 S4.A.2.2.1 S4.A.3.2 S4.A.3.3 S4.A.3.3.1 S4.A.3.3.2 S4.D.3.1.1 S4.D.3.1.2
1	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial	How and why is Earth constantly changing?	N/A	N/A	N/A	N/A	N/A	N/A

	scales.							
1	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	N/A	N/A	N/A	N/A	N/A	N/A
Second Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
2	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	N/A	N/A	N/A	N/A	N/A	N/A
2	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Earth has changed over time with some changes being rapid and others being slow. Sometimes changes occur over a longer period of time than one may be able to observe. (ESS1.C)	Make observations from multiple sources to provide evidence that Earth's events can occur quickly or slowly. (2-ESS1-1)	Erosion Weathering	3.1.4.E 3.5.4.A	3.3.4.A1	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
2	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Wind and water change the shape of the landscape. (ESS2.A)	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. (2-ESS2-1)	Earth materials Erosion Landform Weathering	3.5.4A	3.3.3.A1 3.3.4.A1	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
2	The Earth is a complex	How and why is Earth	Maps display different land	Describe kinds and shapes of	Geographic	4.1.4A	3.3.4.A6	S4.A.1.1

	and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	constantly changing?	and water features and help show patterns in the distribution of rocks and other geological and geographical features. (ESS2.B)	patterns of landforms and bodies of water. (2-ESS2.2)	Geologic Geological Lentic Lotic Map Pennsylvania features	4.1.4B 3.5.4D		S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
2	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Maps show where things are located. One can map the shapes and kinds of land and water in an area. (ESS2.B)	Develop a model to represent the shapes and kinds of land and bodies of water in an area. (ESS2-2)	Model	4.1.4A 4.1.4B 3.5.4D	3.3.4.A6	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
2	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water is found in the ocean, rivers, lakes, ponds, and as groundwater beneath the surface. Water exists as solid ice, in liquid form, and as a vapor. (ESS2.C)	Investigate and represent the various forms of water in their local environment, on Earth, and also on other planets and moons. Use observations to construct explanations that water exists in different forms in natural landscapes. (2-ESS2-3)	Accumulation Condensation Earth Evaporation Groundwater Lake Landscape Liquid Moon Ocean Planet Pond Precipitation River Solid/ice Types of clouds Vapor/Gas		3.3.3.A4 3.3.4.A4	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
2	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere,	How and why is Earth constantly changing?	Water is found in the ocean, rivers, lakes, ponds, and as groundwater beneath the surface. Water exists as solid ice, in liquid form, and as a	Use observations to construct explanations that water exists in different forms in natural landscapes. (2-ESS2-3)	Accumulation Earth Groundwater Ice Lake		3.3.4.A5 3.3.3.A5 3.3.3.A4 3.3.4.A4	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1

	biosphere) that interact over a wide range of temporal and spatial scales.		vapor. (ESS2.C)		Landscape Liquid Moon Ocean Planet Pond River Solid			S4.A.3.2 S4.A.3.3
2	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways.	Investigate what resources are used in the construction of buildings, preparation of food, transportation, and other aspects of the community.	Community Energy Materials Resources Transportation		3.3.4.A2	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
Third Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
3	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth’s place in it?	N/A	N/A	N/A		N/A	N/A
3	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Scientists record patterns of the weather across different times and areas of the weather so that they can make predictions about what kind of weather might happen next. (ESS2.D)	Organize simple weather data sets to record local weather data and identify day-to-day variations, as well as, long-term patterns of weather. (3-ESS2-1)	Atmosphere Data Weather	3.1.4.E 3.5.4.C	3.3.3.A4 3.3.3.A5	S4.A.1.1 S4.A.1.3 S.4.A.1.3.1 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3

3	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over a period of many years. (ESS2.D)	Record and communicate information to describe climates in different regions of the world. (3-ESS2-2)	Climate Conditions Weather	3.5.4.C	3.3.3.A4 3.3.3.A5	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S.4.A.1.3.1 S4.A.3.2 S4.A.3.3
3	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over a period of many years. (ESS2.D)	Display simple data sets in tables and graphs to display previous weather conditions to make predictions for future seasons. (3-ESS2-2)	Climate Weather	3.1.4.C 3.5.4.C	3.3.3.A4 3.3.3.A5	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
3	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Note: ESS3.B is addressed by 4-ESS3-2	Note: 3-ESS3-1 is addressed by 4-ESS3-2	N/A	N/A	N/A	N/A
Fourth Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
4	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	N/A	N/A	N/A		N/A	N/A
4	The Earth is a complex and dynamic set of interconnected systems	How and why is Earth constantly changing?	Local, regional, and global patterns of rock formations reveal changes over time due	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for	Fossils Rock formations	3.5.4.A 3.5.4.D	3.3.3.A1. 3.3.5.A.3	

	(e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.		to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (ESS1.C)	changes in a landscape over time. (4-ESS1-1)				
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms and gravity break rocks, soils, and sediments into smaller particles and move them around. (ESS2.A)	Make observations and measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation (heating cooling, volume of water, speed of wind, deposition, slope, angles, etc.). (4-ESS2-1)	Deposition Erosion Vegetation Weathering	3.5.4.A 3.5.4.D	3.3.5.A1	S4.D.11 S4.A.1.3.3
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Living things affect the physical characteristics of their regions. (ESS2.E)	Make observations and document how living things affect the physical characteristics in different regions. (4-ESS2-1)	Physical characteristics			
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. (ESS2.B)	Analyze and interpret data from maps to describe patterns of Earth's features. 4-ESS2-2)	Biogeology Earthquake Geographic Geologic Hazards Mountain range Natural Plate tectonics Trench Volcano	3.5.4 A 4.1.4 A 4.1.4 B Inquiry Standards 3.1.4.A	3.3.4.A1 4.5.4.D	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
4	The Earth is a complex and dynamic set of	How and why is Earth constantly changing?	The locations of mountain ranges, deep ocean trenches,	Analyze and interpret data from maps to describe Earth's features	Analyze Features			

	interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.		ocean floor structures, earthquakes, and volcanoes occur in patterns. (ESS2.B)	(e.g., mountains, valleys, caves, sinkholes, lakes, rivers, peninsulas, lentic/lotic water systems, etc.). (4-ESS2-3)	Interpret			
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water occurs underground, above ground, and in the atmosphere. (ESS2.A)	Identify various types of water environments in Pennsylvania. (4-ESS2-2)	Lakes Lentic Lotic Ponds Rivers Streams Watersheds	3.3.4.A 4.2.4.B 3.1.4.B		S4.D.1.1.1 S4.D.1.1.2 S4.D.1.1.3
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Many types of rocks and minerals are formed from the remains of organisms or are altered by their activities. (ESS1.C)	Use fossils as evidence to infer that some rocks were formed from the remains of once living organisms. (4-ESS1-1)	Erosion Fossil Landform Organism	3.5.4 B	3.3.4.A3 4.4.4.C	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
4	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The presence and location of certain fossil types indicate the order in which rock layers were formed. (ESS1-C)	Use evidence from patterns in rock formations and fossils in rock layers to support the explanation for a change in landforms and environments over time. (4-ESS1-1)	Minerals Rock layers	3.5.4 B	3.3.4.A3 4.4.4.C	S4.A.1.1 S4.A.1.3 S4.A.2.1 S4.A.2.2 S4.A.3.1 S4.A.3.2 S4.A.3.3
4	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Energy that humans use is derived from multiple natural sources and their use affects the environment in many	Research multiple sources to describe ways that energy and fuels are derived from natural resources and their impact.	Dams Fissile materials Fossil fuels	4.2.4.B 4.8.4.B	4.3.4.A 4.3.4.A	S4.D.1.2.3

			ways. (ESS3.A)	(4-ESS3-1)	Natural resources Solar			
4	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, etc.). Humans cannot eliminate the hazards, but can take steps to reduce the impact. (ESS3.B)	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2)	Earthquake Natural hazard Tsunami Volcanic eruptions Weather			
Fifth Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
5	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	The sun is a star that appears larger and brighter than other stars because it is closer. (ESS1.A)	Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth. (5-ESS1-1)	Relative distance Stars Sun	3.3.8.B	3.3.8.B1	S8.D.3.1 S8.D.3.1.1 S8.D.3.1.3
	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Stars range greatly in their distance from Earth. (ESS1.A)	Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth. (5-ESS1-1)	Apparent brightness Earth Relative distance Stars Sun	3.3.8.B	3.3.8.B1	S8.D.3.1 S8.D.3.1.1 S8.D.3.1.3
	The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted	What is the universe, and what is Earth's place in it?	The orbits of Earth around the sun and of the moon around Earth, together with rotation of Earth about an axis between its north and South poles, cause observable patterns	Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and seasonal appearance of stars in the sky. (5-ESS1-2)	Data Graphical display Patterns Representation Shadows	3.3.8.B	3.3.5.B1	S8.D.3.1 S8.D.3.1.1 S8.D.3.1.3

	physical processes and laws.		(e.g., day and night, length and direction of shadows, different positions of sun, moon, and stars). (ESS1.B)					
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.(ESS2.A)	Construct and analyze models to describe systems interactions among the geosphere, hydrosphere, atmosphere, and biosphere. ((5-ESS2-1)	Atmosphere Biosphere Chemical change Energy flow Geosphere Hydrosphere Model Physical change	3.4.7.B 3.4.7.A	3.3.4.A4 3.3.4.A5	S8.A.1.1 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.1.4 S8.d.1.1.1
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms. (ESS2.A)	Through the creation of a model, explain that the chemical and physical processes that cycle earth materials and form rocks. (5-ESS2-1)	Atmosphere Biosphere Chemical change Energy flow Geosphere Hydrosphere Model Physical change	3.4.7.B 3.4.7.A	3.3.4.A4 3.3.4.A5	S8.A.1.1 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.1.4 S8.d.1.1.1
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Earth's major systems are the geosphere, hydrosphere, and biosphere, which interact in multiple ways to affect the Earth's surface materials and processes. (ESS2.A)	Develop a model to describe the ways the geosphere, hydrosphere, and biosphere interact. This could include the influence of atmosphere on landforms and ecosystems though weather and climate, mountain ranges on winds and clouds, etc. (5-ESS2-1)	Atmosphere Biosphere Geosphere Hydrosphere	3.4.7.B 3.4.7.A	3.3.4.A4 3.3.4.A5	S8.A.1.1 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.1.4 S8.d.1.1.1

5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. (ESS2.A)	Develop a model to describe the ways the geosphere, hydrosphere, and biosphere interact. (5-ESS2-1)	Atmosphere Biosphere Geosphere Hydrosphere	3.4.7.B 3.4.7.A	3.3.4.A4 3.3.4.A5	S8.A.1.1 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.1.4 S8.d.1.1.1
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (ESS2.A)	Utilizing observations and data, explain the patterns of weather in a given location. (5-ESS2-1)	Weather	3.5.7.C	3.3.5.A5 3.3.6.A5	S8.D.2.1 S8.D.2.1.1 S8.D.2.1.2 S8.D.2.1.3
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Most fresh water is in glaciers or underground with the remainder in streams, lakes, wetlands, and atmosphere. (ESS2.C)	Using real time data, graph amounts of water in various reservoirs to provide evidence about the distribution of water on earth. (5-ESS2-2)	Distribution	3.1.7.A 3.1.7.B 3.1.7.E 3.1.7.C 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.A4	S8.D.1.3 S8.D.1.3.4
5	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land.	Investigate movement of water in the Earth's systems and research and develop models for the cycling of water.	Atmosphere Precipitation Transpiration Water cycle Water system	3.5.7.D	3.3.5.A4 3.3.6.A4 3.3.8.A4	S8.A.1.1 S8.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.D.1.3.1
5	The Earth's processes affect and are affected by	How do Earth's processes and human activities affect	Human activities in agriculture, industry, and	Research and communicate how	Atmosphere Human impact	3.5.7.B 3.8.7.B	4.3..10.A	S8.A.1.1 S8.A.1.3

	human activities.	each other?	everyday life have had major effects on land, vegetation, streams, ocean, and air. (ESS3.C)	communities are using science to protect resources and environments. (5-ESS3-1)	Research Resources			S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.D.1.1 S8.B.3.3 S8.C.2.2.3
Middle School								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	The phases of the Moon are caused by the orbit of the moon around the Earth. (ESS1.A)	Identify and explain monthly patterns in the phases of the Moon.	Orbit Pattern Phase Waning Waxing	3.4.4.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.B2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	The phases of the Moon are caused by the orbit of the moon around the Earth. (ESS1.A)	Use a model of the relative positions of the sun, earth and moon to explain the phases of the moon.	Orbit Pattern Phase Waning Waxing	3.4.4.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.B2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Observable patterns and changes in tides are caused by the Earth-Moon-Sun system. (ESS1.B)	Use models of the Earth-Sun-Moon system to support explanations and predict the cyclic patterns of tides.	Gravity Neap tide Spring tide System Tide	3.4.4.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C	3.3.7.A4 3.3.6.B1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3

						3.2.7.D		S8.D.3.1.1 S8.D.3.1.2
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Observable eclipses are caused by motions in the Earth-Moon-Sun system. (ESS1.A)	Use models of the Earth-Sun-Moon system to support explanations and predict the cyclic patterns of eclipses.	Lunar Eclipse Penumbra Solar Eclipse Umbra	3.4.4.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.7.B2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
6-8	The universe is composed of a variety of different objects which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Earth's spin axis is fixed in direction and tilted relative to its orbit around the sun. The seasons are a result of the Earth's tilt on its axis and are caused by the differential intensity of sunlight on different areas of Earth throughout the year. (ESS1.B)	Use models of Earth's orientation and motion to explain how changes in intensity and duration of daily sunlight lead to seasons.	Axis Cyclical pattern Earth Orbit Orientation Position Revolution Rotation Season Tilt	3.4.4.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.B2 3.3.6.B2 3.3.7.B2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1
6-8	The universe is composed of a variety of different objects which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Earth's spin axis is fixed in direction and tilted relative to its orbit around the sun. The seasons are a result of the Earth's tilt on its axis and are caused by the differential intensity of sunlight on different areas of Earth across the year. (ESS1.B)	Identify and explain the position and orientation of the Earth as it orbits the Sun.	Axis Cyclical pattern Earth Orbit Orientation Position Revolution Rotation Season Tilt	3.4.4.D 3.4.7.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.B2 3.3.6.B2 3.3.7.B2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1 S8.D.3.1.2
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and	What is the universe, and what is Earth's place in it?	Earth and its solar system are part of the Milky Way Galaxy, which is one of many galaxies in the universe. (ESS1.A)	Construct and use scale models to describe the relationship of Earth to the rest of the solar system, the Milky Way Galaxy, and the universe.	Galaxy Moon Satellite Solar system Universe	3.4.7.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B	3.3.6.B1 3.3.5.B1 3.3.7.B1 3.3.7.B2 3.3.8.B1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2

	laws.					3.2.7.C 3.2.7.D		S8.A.3.3 S8.D.3.1.1 S8.D.3.1.2 S8.D.3.1.3
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Our solar system is a collection of objects, including planets, their moons, and asteroids that are held in orbit around the Sun by its gravitational pull on them. (ESS.B)	Construct and use scale models of the solar system to support the explanation of the role of gravity in the motions of the planets of the observed system.	Asteroids Gravity Moon Satellite Solar system	3.4.7.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.B1 3.3.6.B1 3.3.7.A4 3.3.7.B1 3.3.6.B2 3.3.7.B2 3.3.8.B1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1 S8.D.3.1.2
6-8	The universe is composed of a variety of different objects, which are organized into systems, each of which develops according to accepted physical processes and laws.	What is the universe, and what is Earth's place in it?	Our solar system is a collection of objects, including planets, their moons, and asteroids that are held in orbit around the Sun by its gravitational pull on them. (ESS1.B)	Analyze and interpret data to determine scale properties (i.e. distance from sun, diameter, etc.) of objects in the solar system.	Asteroids Gravity Moon Satellite Solar system	3.4.7.D 3.1.7.A 3.1.7.B 3.1.7.C 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.B1 3.3.6.B1 3.3.7.A4 3.3.7.B1 3.3.6.B2 3.3.7.B2 3.3.8.B1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.3.1.1 S8.D.3.1.3
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.(ESS2.A)	Construct and analyze models to describe systems interactions among the geosphere, hydrosphere, atmosphere, and biosphere.	Atmosphere Biosphere Geosphere Hydrosphere	3.5.7.A 3.5.7.C 3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.A4 3.3.4.A5 3.3.8.A1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2 S8.D.1.1.3 S8.D.2.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and	Classify rocks as one of three different types and explain the interrelationship of the rock types as	Erosion Geosphere Igneous rock	3.5.7.A 3.1.7.A 3.1.7.B	3.3.4.A4 3.3.4.A5 3.3.7.A1	S8.A.1.1 S8.A.1.2 S8.A.1.3

	(e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.		among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.(ESS2.A)	part of the rock cycle. (e.g., igneous: granite, basalt, obsidian, pumice; sedimentary: limestone, sandstone, shale, coal; and metamorphic: slate, quartzite, marble, gneiss).	Metamorphic rock Rock cycle Sedimentary rock Weathering	3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D		S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.1
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.(ESS2.A)	Plan and carry out investigations that investigate models of the chemical and physical processes that cycle earth materials and form rocks.	Geosphere Energy flow Erosion Igneous Metamorphic Rock cycle Sedimentary Weathering	3.5.7.A 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.A4 3.3.4.A5 3.3.7.A1 3.3.8.A1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.1 S8.D.1.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.(ESS2.A)	Compare and contrast various soil types and their characteristics found in different biomes (e.g, regionally, nationally, globally) and explain how they were formed.	Biome Geosphere Energy flow Erosion Rock cycle Soil horizons Weathering	3.5.7.A 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.4.A4 3.3.4.A5 3.3.6.A2 3.3.7.A2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.3
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water continually cycles among geosphere, hydrosphere, biosphere, and atmosphere via transpiration, evaporation, condensation, and precipitation. (ESS2.C)	Develop models for the movement of water within the Earth's spheres (i.e., geosphere, hydrosphere, biosphere, atmosphere).	Atmosphere Condensation Evaporation Hydrosphere Infiltration Precipitation Runoff Transpiration Water Cycle	3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.A4 3.3.6.A4 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.3.1

					Water System			
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water continually cycles among geosphere, hydrosphere, biosphere, and atmosphere via transpiration, evaporation, condensation, and precipitation. (ESS2.C)	Compare and contrast characteristics of freshwater and saltwater systems on the basis of their physical characteristics.	Density Freshwater Hydrosphere Salinity Saltwater	3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.A4 3.3.6.A4 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.3.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water continually cycles among geosphere, hydrosphere, biosphere, and atmosphere via transpiration, evaporation, condensation, and precipitation. (ESS2.C)	Investigate water systems to identify seasonal and annual variations in precipitation and streamflow and the causes of those variations.	Flow rate Hydrosphere Ocean systems River systems Watershed Wetland	3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.A4 3.3.6.A4 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.3.2 S8.D.1.3.3 S8.D.1.3.4
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Water continually cycles among geosphere, hydrosphere, biosphere, and atmosphere via transpiration, evaporation, condensation, and precipitation as well as downhill flows on land. (ESS2.C)	Assess the physical characteristics of a stream to determine the types of organisms found within the stream environment.	Biological diversity Flow rate River systems Stream Tributary Watershed	3.5.7.C 3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.5.A4 3.3.6.A4 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.3.2 S8.D.1.3.3 S8.D.1.3.4
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact	How and why is Earth constantly changing?	Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with	Collect data and generate evidence to show how changes in weather conditions result from the movement, interactions, and area of origin of air masses (e.g., cold, dry Canadian air mass vs. warm, moist southern air	Air pressure Atmosphere Altitude Barometer Climate Density	3.5.7.C 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B	3.3.7.A6 3.3.6.A6 3.3.6.A5 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1

	over a wide range of temporal and spatial scales.		latitude, altitude and local and regional geography resulting in complex patterns that are difficult to predict. (ESS2.D)	mass).	Geography Latitude Weather Weather Front	3.2.7.C 3.2.7.D		S8.A.3.2 S8.A.3.3 S8.D.2.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude and local and regional geography resulting in complex patterns that are difficult to predict. (ESS2.D)	Construct and use models to support the explanation of how the uneven distribution of solar energy affects global patterns in atmospheric and oceanic circulation.	Air pressure Altitude Atmosphere Barometer Circulation Climate Downwelling Geography Hydrosphere Latitude Oceanic Upwelling Weather	3.5.7.C 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.7.A6 3.3.6.A6 3.3.6.A5 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.1 S8.D.2.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude and local and regional geography resulting in complex patterns that are predicted with varying degrees of reliability. (ESS2.D)	Analyze weather patterns using cloud types, wind directions, and barometric pressure.	Air pressure Atmosphere Barometer Cirrus Cumulus Stratus Weather	3.5.7.C 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.7.A6 3.3.6.A6 3.3.6.A5 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.3
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The ocean and other large bodies of water exert a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents that are driven by differences in density relative to temperature and salinity.	Construct explanations from models of oceanic and atmospheric circulation, and for the development of local and regional climates.	Atmosphere Atmospheric circulation Climate Density Hydrosphere Oceanic circulation Salinity	3.5.7.C 3.5.7.D 3.1.7.A 3.1.7.B 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3. .3.7.A6 3.3.6.A6 3.3.6.A5 3.3.8.A4	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.1 S8.D.2.1.2

6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Major events in Earth's history leave evidence in the geologic record that allow the construction of a geologic time scale based on relative ages. (ESS1.C)	Use geologic evidence to construct patterns and determine the relative ages and sequence of geologic events in Earth's 4.6 billion year history.	Geosphere Geologic time Index fossils Law of superposition Relative age Scale	3.5.7.A 3.5.7.B 3.1.7.D 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.7.A3	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2 S8.D.1.1.4
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The Earth's systems interact on various time and size scales. These interactions have shaped Earth's history and will determine its future. (ESS2.A)	Construct an explanation based on evidence for how various processes have changed Earth's surface at varying time and spatial scales (e.g., short-term deposition vs. mountain building; short-term weathering and erosion vs. canyon or valley formation).	Erosion Geosphere Plate tectonics Sea floor spreading Subduction Weathering	3.5.7.A 3.5.7.B 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.A1 3.3.7.A1 3.3.8.A1 3.3.10.A1	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2 S8.D.1.1.4
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Plate tectonics is the unifying theory that explains the past, and current, and future movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (ESS2.B)	Develop and use models of past plate motions to support explanations of existing patterns in the fossil record, rock record, continental shapes and sea floor structures.	Asthenosphere Continent Continental drift Convection Fossil record Geosphere Lithosphere Mantle Rock record Plate motion Plate tectonics Seafloor Spreading	3.5.7.A 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.A1 3.3.7.A6 3.3.8.A6	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2 S8.D.1.1.4
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact	How and why is Earth constantly changing?	Plate tectonics is the unifying theory that explains the past, and current, and future movements of the rocks at Earth's surface and provides a framework for	Incorporate a variety of data including geological evidence from maps and representations of current plate motions to predict future plate motions.	Asthenosphere Continental drift Convection Geosphere Fossil record Lithosphere	3.5.7.A 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B	3.3.6.A1 3.3.7.A6 3.3.8.A6	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2

	over a wide range of temporal and spatial scales.		understanding its geological history. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (ESS2.B)		Mantle Plate motion Plate tectonics Rock record Seafloor Spreading	3.2.7.C 3.2.7.D		S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Plate tectonics is the unifying theory that explains the past, and current, and future movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (ESS2.B)	Use models to explain how the flow of energy (convection of heat) drives the cycling of matter between Earth's surface and deep interior.	Convection Convergence Crust Divergence Geosphere Inner core Mantle Outer core Plate tectonics	3.4.7.B 3.5.7.A 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.A1 3.3.7.A6 3.3.8.A6	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Some natural hazards such as volcanic eruptions and severe weather may be preceded by phenomena that allow for reliable prediction. Others such as earthquakes occur suddenly with no notice and are not yet predictable. (ESS3.B)	Investigate or develop a map of the past and present natural hazards in a region to demonstrate an understanding of forecasting the likelihood of future events and to inform designs for development of technologies to mitigate their effects.	Earthquake Floods Geosphere Hurricane Natural hazard Tornado Tsunami Volcanoes	3.5.7.A 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.8.A6 3.3.10.A1 3.3.10.A6	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.2
6-8	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Evolution is shaped by Earth's varying geological and environmental conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. (ESS3.C)	Use evidence from the rock and fossil records to construct arguments that explain how past changes in earth's conditions have caused major extinctions of some life forms and allowed others to flourish.	Eruption Extinction Fossil record Geosphere Mass Meteor impact Volcanic	3.4.7.D 3.5.7.A 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.7.A3	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.1.4

6-8	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Humans depend on Earth's land, ocean, atmosphere, and living things for many different resources. (ESS3.A)	Describe a product's transformation process from production to consumption.	Atmosphere Consumption Geosphere Hydrosphere Natural resources Nonrenewable resources Ore Production Renewable resources	3.5.7.B 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.8.A2 3.3.8.A3	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.B.3.2 S8.D.1.2.1
6-8	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Minerals, fresh water, and living resources are limited, and many are not renewable or replaceable over human lifetimes. (ESS3.A)	Use maps and other data to explain how geologic processes have led to the uneven distribution of Earth's natural resources.	Atmosphere Climate Fossil record Geosphere Hydrosphere Mineral Natural Plate tectonics Resources	3.5.7.A 3.5.7.B 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.6.A1 3.3.8.A2 3.3.8.A3	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.B.3.2 S8.D.1.1.2 S8.D.1.2.1
6-8	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Minerals, fresh water, and living resources are limited, and many are not renewable or replaceable over human lifetimes. (ESS3.A)	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	Atmosphere Consumption Geosphere Hydrosphere Mineral Natural Nonrenewable resources Population growth Renewable resources Resources	3.5.7.B 3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D	3.3.8.A2 3.3.8.A3 3.3.10.A2	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.B.3.3 S8.D.1.2.2
6-8	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Human activities influence Earth's global temperature, and these effects can be mitigated through applying	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	Atmosphere Biosphere Carbon dioxide (CO_2)	3.5.7.C 3.1.7.A 3.1.7.D 3.1.7.E	3.3.7.A5 3.3.8.A5 3.3.10.A6	S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1

			knowledge of climate science, engineering, etc. (ESS3.D)		Climate Global warming	3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D		S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.2.1.1 S8.D.2.1.2 S8.D.2.1.3
6-8	The Earth's processes affect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Human activities have significantly altered the biosphere and geosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. (ESS3.D)	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	Biosphere	3.1.7.A 3.1.7.D 3.1.7.E 3.2.7.A 3.2.7.B 3.2.7.C 3.2.7.D		S8.A.1.1 S8.A.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.A.3.1 S8.A.3.2 S8.A.3.3 S8.D.1.2.2
High School								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	The Milky Way Galaxy consists of more than two hundred billion stars, the sun being one of them, and is one of hundreds of billions of galaxies in the known universe.	Use models to describe the sun's place in space in relation to the Milky Way Galaxy and the distribution of galaxy clusters in the universe.	Clusters Galaxy Model Star Universe	3.4.10.D	3.3.10.B1	
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	Models of the formation and structure of the universe have changed over time as technologies have become more advanced and the accuracy of our data has increased.	Compare time periods in history, the technology available at that time and the resulting model of the organization of our solar system. (e.g. – Early Greeks used purely observational data resulting in a geocentric model).	Geocentric Heliocentric Model Planet Theory	3.1.12.E	3.4.10.B 3.4.10.D3	
9-12	The universe is composed of a variety of different	What is the universe and what is Earth's place in it?	The Milky Way Galaxy consists of more than two	Use data about the expansion, scale and age of the universe to explain	Clusters Galaxy	3.4.10.D	3.3.10.B1 3.3.12.B2	

	objects that are organized into systems each of which develops according to accepted physical processes and laws.		hundred billion stars, the sun being one of them, and is one of hundreds of billions of galaxies in the known universe.	the Big Bang theory as a model for the origin of the Universe.	Light year Model Theory			
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	There are multiple sources of evidence for the Big Bang theory including the measurement of red shift, the amount of hydrogen and helium in the universe, and the cosmic microwave background radiation that fills the universe.	Construct explanations based on observable astronomical data as empirical evidence for the Big Bang theory.	Blue shift Cosmic microwave background radiation Electromagnetic spectrum Non-solar gases Red shift Stellar spectra	3.4.10.D	3.3.10.B1 3.3.12.B2	
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	The compositions and masses of stars determine their life cycle.	Compare and contrast the life cycles of stars of different masses and compositions, including our sun.	Black hole Dwarf HR diagram Main sequence Nebula Neutron star Nova Protostar Red giant Supernova	3.4.10.D	3.3.12.B1	
9-12	The universe is composed of a variety of different objects, which are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	The compositions and masses of stars determine their life cycle.	Develop a model of how the competing forces of gravity and thermal expansion effect a star's density throughout its life cycle.	Density Gravity Thermal expansion	3.4.10.D 3.4.12.D	3.3.12.B1	
9-12	The universe is composed of a variety of different objects that are organized into systems each of	What is the universe and what is Earth's place in it?	The brightness and magnitude of a star are determined by mass, temperature and distance	Use observational data to construct an explanation of a star's apparent (relative) magnitude based on its distance from the observer and its	Absolute magnitude Apparent (relative)	3.4.10.D 3.4.12.D	3.3.12.B1	

	which develops according to accepted physical processes and laws.		from the observer.	mass.	magnitude			
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	Nuclear fusion within stars produces all atomic nuclei lighter than and including iron. Heavier elements are produced and distributed through supernovae.	Describe the mechanism by which heavier and heavier elements are produced within a star's core throughout its life cycle.	Elements Nuclear fusion Nuclei Supernova	3.4.10.D	3.3.12.B1	
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	The study of a star's spectra is used to identify compositional elements of a star.	Use observational data to describe the composition of stars.	Elements Spectra	3.4.10.D	3.3.10.B2, 3.3.12.B1	
9-12	The universe is composed of a variety of different objects that are organized into systems each of which develops according to accepted physical processes and laws.	What is the universe and what is Earth's place in it?	Kepler's laws describe the motions of orbiting objects, including their elliptical paths around the Sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	Use mathematical and computational representations of human-made and solar system objects in order to describe their motions and predict their trajectories and/or collisions.	Elliptical Kepler's laws Satellite Trajectory	3.4.12.B	3.3.10.B1, 3.3.12.A1	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Radioactive dating to can be used to determine the ages of rocks and other materials from the isotope ratios that are present. These data can be used to help determine the geologic time scale.	Analyze actual or simulated isotope ratios within earth materials to make valid and reliable scientific claims about the planet's age; the ages of earth events and rocks; and the overall time scale of earth's history. (Consider the incomplete nature of the Earth's rock record when analyzing and interpreting the events	Elements Geologic time scale Half-life Isotope Radioactive (radiometric) dating	3.5.12.A	3.3.12.A1 3.3.10.A1 3.3.12.A3	

				of Earth's distant past.)				
	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Plate tectonics is the unifying theory that explains the geologic movements of the Earth.	Develop a three dimensional model to illustrate how Earth's internal and surface processes operate to form continental and ocean floor features.	Asthenosphere Conduction Convection Convergence Crust Density Earthquake Erosion Hot spot Inner core Lithosphere Mantle Mid-Ocean ridge Mountain-building Outer core Pangaea Plate boundaries Rift Rock cycle Seafloor spreading Subduction zone Topography Transform Volcano Watershed	3.5.10.A	3.3.10.A1	
	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Plate tectonics is the unifying theory that explains the geologic movements of the Earth.	Incorporate a variety of data including geological evidence from maps and representations of current plate motions to predict future plate motions.	Crust Mantle Convection Convergent Divergent Transform Sea-floor spreading Mid-ocean	3.5.10.A	3.3.12.A1 3.3.10.A1 3.3.12.A3	

					ridge Mountain-building			
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.	Use a model for Earth's interior including the mechanisms of thermal convection to support the explanation for the cycling of matter within the Earth.	Crust Cycling of matter Geochemical cycle Isotopes Mantle Plate Tectonics Radioactive decay Thermal convection	3.5.12.A	3.3.12.A1 3.3.12.A3	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	In addition to studying the early rock record, scientists can also learn about early Earth by studying objects in the solar system such as lunar rocks, asteroids, comets, and meteorites, which have changed little over time.	Construct an account of Earth's formation and early history (e.g. – origin of oceanic and atmospheric components) from evidence acquired from the study of ancient Earth materials and objects in our solar system.	Asteroid Comet Geology Meteorite Volcanic activity	3.5.10.A	3.3.12.A3	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Continental rocks, which can be older than 4 billion years, are generally much older than rocks on the ocean floor, which are less than 200 million years old.	Construct explanations using the theory of plate tectonics for patterns in the general trends of the ages of both continental and oceanic crust.	Basalt Continental crust Granite Igneous Mantle Metamorphic Mid-ocean ridge Mountain-building Oceanic crust Paleo-magnetism Plate tectonics	3.5.10.A	3.3.12.A1 3.3.10.A1 3.3.12.A3	

					Rock cycle Sea-floor spreading Sedimentary Subduction			
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Our model of Earth includes a hot but solid inner core, a liquid outer core, a plastic mantle, and a solid crust.	Integrate evidence from seismic waves, reconstructions of Earth's magnetic field and states of matter to map the boundaries of the internal structure of the Earth.	Crust Inner core Liquid Magnetic field Mantle Outer core Plasticity Seismic waves Solid	3.5.10.A	3.3.12.A1 3.3.10.A1 3.3.12.A3	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual coevolution of Earth's surface and its organisms.	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on earth.	Atmosphere Biosphere Fossil Geosphere Hydrosphere Lithosphere	3.1.10.A	3.3.10.A3	BIO.B.3.2.1
	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Biogeochemical cycles provide Earth's interconnected systems with a flow of energy and cycling of matter.	Develop qualitative models to describe biogeochemical cycles among the hydrosphere, atmosphere, geosphere, and biosphere.	Atmosphere Biosphere Carbon cycle Chemical properties Geosphere Hydrosphere Nitrogen cycle Water (hydrologic) cycle Phosphorous cycle Photosynthesis Physical properties	3.1.10.A 3.1.12.A 3.5.10.C 3.5.10.D	3.3.10.A2 3.3.10.A3 3.3.10.A4 3.3.10.A5 3.3.12.A5	BIO.B.4.2.3

9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Earth's climate depends on the sun's output of electromagnetic radiation, as well as that energy's reflection, absorption and re-radiation by various Earth systems and types of surfaces.	Use models of the flow of energy between the sun and Earth's atmosphere, ocean and land to support explanations of how Earth's radiative energy balance is affected by the absorption and retention of heat in Earth's atmosphere.	Absorption Atmosphere Biosphere Climate Electromagnetic radiation Equilibrium Geosphere Hydrosphere Radiation Re-radiation Reflection	3.5.12.C	3.3.12.A6	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Climate changes happen on various time scales (e.g. - sun's energy output, Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and/or human activities).	Use data to graphically represent and draw conclusions about the causes and effects of climate change over 10-100s years; 1,000s-10,000s years; and 100,000s-1,000,000s.	Climate change Global warming	3.5.10.C	3.3.12.A6	
9-12	The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.	How and why is Earth constantly changing?	Climate changes happen on various time scales (e.g. - sun's energy output, Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and/or human activities).	Use geoscience data and the results from global climate models to make evidence-based forecasts of climate change.	Climate change Climate models El Nino Global warming Greenhouse gases La Nina Meteorology	3.5.12.C	3.3.12.A.6	
9-12	The Earth's processes effect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Resource availability has influenced the development of human society.	Evaluate the impact of the availability of renewable and nonrenewable resources on the development of a civilization.	Biofuels Civilization Nonrenewable Renewable Resources Society	3.5.10.B 3.8.10.A	3.3.12.A2	
9-12	The Earth's processes effect and are affected by	How do Earth's processes and human activities affect	The extraction of resources and production of energy	Evaluate the impact on Earth's systems of using renewable and	Benefit Biogeochemica	3.5.10.B 3.5.12.B	3.3.12.A2 3.3.10.A7	

	human activities.	each other?	have benefits and risks.	nonrenewable resources. .	l cycles Biome Biosphere Carrying capacity Community Consumption Cost Desertification Earth system Ecology Economical Ecosystem Environment Extinction Geopolitical Habitat Nonrenewable Pollution Population Renewable Risk Species Sustainability System Temperature		3.3.12.A7 4.1.10.B 4.1.12.B 4.1.10.C 4.1.12.C 4.3.10.A 4.3.12.A 4.3.10.B 4.3.12.B 4.5.10.A	
9-12	The Earth's processes effect and are affected by human activities	How do Earth's processes and human activities affect each other?	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species.	Investigate human environmental impacts, comparing the kinds of solutions that are feasible, and designing and analyzing solutions that could reduce that impact (e.g. examples of human impacts can include water usage, such as the withdrawal of water from streams and aquifers or the construction of dams and levees; land usage such as urban development, agriculture or the removal of wetlands; and pollution such as of the air, water or	Abiotic Biotic Conservation Evidence Extinction Human impact Hypothesis Land use Model Pollution Urban development Wetlands	3.8.10.A 3.8.10.B 3.8.10.C 3.8.12.A 3.8.12.B 3.8.12.C	4.1.10.A 4.1.12.A 4.5.10.D 4.1.10.E 4.2.10.B 4.2.12.B 4.5.12.A	

				land.				
9-12	The Earth's processes effect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species.	Construct an argument from evidence for how increases in human population and consumption of natural resources impact Earth's systems. (Examples of evidence include appropriate databases on human populations and the rates of consumption of food and natural resources such as fresh water, minerals and energy. Examples of impacts may include changes to the appearance, composition and structure of Earth's systems as well as the rates at which they change.) NOTE: The consequences of increases in human populations and consumption of natural resources are *described* by science. Even though science does not decide upon the actions societies take, science can help predict the consequences of those actions.	Biogeochemical cycles Carrying capacity Consumption Earth systems Equilibrium Hypothesis Model Natural resources Non-point source pollution Point source pollution Rate of consumption Risk management Scientific evidence	3.8.10.A 3.8.10.B 3.8.10.C 3.8.12.A 3.8.12.B 3.8.12.C	3.3.10.A7 3.3.12.A7 4.1.10.A 4.5.10.C 4.5.12.C	
9-12	The Earth's processes effect and are affected by human activities.	How do Earth's processes and human activities affect each other?	Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste.	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	Best management practices Engineering design process Green infrastructure Mitigation Model Pollution Technology Recycling Sustainability	3.8.10.B 3.8.12.B 3.8.10.C 3.8.12.C	3.4.10.A3 3.4.12.A3 4.5.12.D 4.1.12.E 4.3.10.D 4.3.12.D	

					Waste management			