EARTH AS A SYSTEM

Theme/Questions	K-2	3-5	6-8	9-12
How is the Earth part of a larger system?	The Earth is part of a bigger system called the Solar System.	The Earth is part of the Solar System.	The Earth is part of the Solar System.	The Earth is part of the Solar System.
How do the four spheres (lithosphere, atmosphere, hydrosphere, biosphere) interact?		The Earth's position in relation to the Sun changes what happens on Earth.	The relative positions of Earth and Sun affect the dynamics of the Earth.	The tilt of the Earth's axis and the Earth's orbit affect Earth's seasons, climate belts, and global wind and ocean currents.
What evidence is there of this interaction?				The gravitational forces of the moon, sun, and all other celestial bodies influence the Earth.
	The planet Earth has a distinct internal structure composed of the crust, mantle, and core.	The planet Earth has distinct layers (crust, mantle, and core) that look and act differently.	The planet Earth is made of layers distinguished by composition, structure, and temperature.	The planet Earth is made of layers distinguished by composition, structure, and temperature.
	Earth is made up of land, water, air, and living things.	Earth is composed of land, water, air, and living things.	The planet Earth is composed of the lithosphere, hydrosphere, atmosphere, and biosphere. The boundaries of these spheres are not fixed.	The planet Earth is composed of lithosphere, hydrosphere, atmosphere, and biosphere. The boundaries of these spheres are not fixed.
	Land is solid and is made of rocks, soils and living things. There are different kinds of rocks. Land has different shapes called landforms.	The properties of rocks and minerals in the crust reflect processes that form them. Different landforms result from wind, water, and earth movements.	The lithosphere is composed of oceanic and continental plates that move along the plate boundaries as a result of convection currents in the Earth's mantle. Plate movements, along with weathering, erosion, and deposition are responsible for many of Earth's landforms. The properties of rocks and minerals in the crust reflect processes that form them.	The lithosphere is composed of oceanic and continental plates that move along the plate boundaries as a result of convection currents in the Earth's mantle. Different landforms result from plate movements, weathering, erosion, and deposition. Minerals and rocks have physical and chemical properties that provide evidence of the processes through which they were formed.
	Water forms rivers, lakes, and oceans. Water can also exist as ice, mist, clouds, and steam.	Water exists on the Earth's surface (oceans, rivers, ice) and in the air (atmosphere). Water is an important agent of change on the Earth's surface.	Water cycles among the lithosphere, biosphere, and atmosphere. Water acts as an important agent of change on the Earth's surface and lithosphere.	Water cycles among the lithosphere, biosphere, and atmosphere. Water, in its various states, acts as an agent of change on the Earth's surface.
	We live on Earth, along with all other living things (other plants and animals). People, other animals, and plants need air, food water, and a place to live.	All four spheres interact with one another. These interactions are reflected in the different biomes and ecosystems.	All four spheres interact with one another. These interactions are important in determining the Earth's surface, weather, and ecosystems.	The interaction of the four spheres shape the Earth's surface, weather, and ecosystems.

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CHANGE

Theme/Questions	K–2	3–5	6–8	9–12
In what ways does the Earth change? What causes change in the Earth? What is the evidence that change has occurred?	The Earth changes over time. Some changes are fast and some are slow. Some changes are big and some are small.	The Earth changes over time. Some changes take a long time (climate), some changes happen more quickly (weather). There are large-scale changes (earthquakes, tsunami, volcano) and more ordinary changes (weathering, erosion, glaciation).	The Earth is always changing. There are short-term and long-term, large-scale and small-scale changes.	The Earth is always changing. There are short-term and long-term, large-scale and small-scale changes. Rates of change are dependent upon the agent of change.
	Earth's surface is always changing. Rocks break down into smaller pieces.	Some changes build land features (mountain building), some changes tear them down (mountains/rocks/sand—rock cycle).	There are constructive and reconstructive changes.	There are constructive and reconstructive changes, sometimes occurring concurrently (e.g., volcanic eruption). There are many kinds of energy at work: heat, chemical, kinetic, potential, radioactive. Changes occur due to the transfer of energy.
	Land changes as a result of earthquakes, volcanoes, and wind and water activity.	Water, wind, ice, temperature changes and vegetation are forces that change the Earth's surface and crust.	Changes occur due to the transfer of energy.	
	The sun affects changes in temperature, weather, and the seasons. Water can change into different forms when the temperature changes.	The sun is the source of temperature change. Temperature changes affect weather and distribution of organisms.	The sun is the external source of energy driving changes on the Earth's surface.	The sun is the primary external source of energy driving changes on the Earth's surface, hydrosphere, and atmosphere.
			The Earth's interior is the internal source of energy driving large-scale changes in the lithosphere (plate tectonics) and Earth's surface. Internal and external convection currents are caused by an unequal distribution of heat. Convection currents drive movements within the lithosphere, hydrosphere, and atmosphere.	The Earth's interior contains sources of heat energy driving large-scale changes in the lithosphere (plate tectonics) and Earth's surface. Internal and external convection currents are caused by an unequal distribution of heat. Convection currents drive movements within the lithosphere, hydrosphere, and atmosphere. The transfer from potential to kinetic energy is responsible for changes in the Earth's surface.
	Life has changed through time. Fossils provide evidence that life has changed.	Life has changed through time. Fossils provided evidence that life has changed.	Life has changed through time. There are multiple lines of evidence for evolution: fossils, anatomy, molecules, development, and geology.	Life has changed through time. There are multiple lines of evidence for evolution: fossils, anatomy, molecules, development, geology, geographic distribution, and experimentation. The biosphere influences and is influenced by both internal and external energy transfers.

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MATERIALS ARE CONSERVED AND RECYCLED

Theme/Questions	K–2	3–5	6–8	9–12
How are materials in the Earth conserved and recycled?	Rocks break down into smaller pieces. When rocks get hot enough, they melt.	Rocks are recycled from one type to another.	Rocks are recycled from one type to another (the rock cycle).	All materials on Earth, including water, rock, carbon, and nitrogen, are conserved and recycled through the four spheres.
What is our evidence that materials are conserved and recycled? Where do rocks come from? What are the responsibilities of humans toward natural resources?	Magma is a source of new rocks.	Cooling of magma near the Earth's surface creates rock in the Earth's crust.	Plate tectonics is an essential force that drives the rock cycle. New rock is created at divergent boundaries by magma pushing up from the mantle. At subduction zones, existing rocks can be melted and recycled. Heat and pressure associated with plate interaction can change existing rock.	Formation, weathering, sedimentation, and reformation constitute a continuing "rock cycle" in which the total amount of material is conserved and recycled. Plate tectonics and weathering drive the rock cycle.
		Rocks break down into smaller pieces as a result of the action of waves, wind, water, and ice (weathering). Once rocks are broken down, they are carried by wind and water (erosion) and deposited elsewhere (deposition).	Surface rocks break down as a result of the action of waves, wind, water, and ice (weathering) and are then carried by gravity, wind, and water (erosion) and deposited elsewhere (deposition).	
	There are different kinds of rocks. We group rocks based on their characteristics.	We group rocks based on the way they were formed. There are three types of rock: igneous, sedimentary, and metamorphic.	We classify rocks based on the way they were formed: igneous, metamorphic, and sedimentary. Properties of rocks are determined by the physical and chemical conditions under which they formed.	Properties of rocks are determined by the physical and chemical conditions under which they formed. Rocks are classified by the processes that formed them.
	Water freezes when it is very cold. Ice/snow melts when it gets warmer. Rain comes from clouds. Rain puddles dry up (evaporate). Hot water makes steam.	Water exists on Earth as liquid (lakes, oceans, rivers), as solid (ice, glaciers, polar cap), and as gas (water vapor in atmosphere).	Water exists on Earth as liquid (lakes, oceans, rivers), as solid (ice, glaciers, polar cap), and as gas (water vapor in atmosphere).	There are different physical forms of water in the atmosphere, lithosphere, hydrosphere, and biosphere. Water cycles during both organic and inorganic processes.
		Water changes form (water cycle). The amount of change is related to the rate of change in the temperature. The sun is important in the water cycle.	Water circulates through the lithosphere, biosphere, and atmosphere. Water occurs as a solid, liquid, or gas and changes state as it absorbs or releases heat. The sun is the primary source of heat.	
				There are different physical and chemical forms of carbon in the Earth's spheres. Carbon cycles during photo-

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MATERIALS ARE CONSERVED AND RECYCLED (continued)

	K–2	3–5	6–8	9–12
				synthesis and respiration, combustion of fossil fuels, and organic decay. There are different physical and chemical forms of nitrogen in the Earth's spheres. Nitrogen cycles during organic and inorganic processes.
	All resources used by humans come ultimately from the Earth. Many of these resources are not in endless supply. Earth's resources must be used with care.	All resources used by humans come ultimately from the Earth. Many of these resources are not in endless supply. Some of these resources are nonrenewable; they cannot be replaced, or can only be replaced at extremely slow rates.	Recycling/reuse of natural resources is a responsibility of humans. Wastes must be handled in a way that has the least detrimental effect on the environment.	Recycling/reuse of natural resources is a responsibility of humans. Nonrenewable resources can be conserved through careful use, recycling, and application of energy. The use of natural resources always involves the need for environmental reclamation. Use of renewable resources for energy sources results in a net gain in resources.

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EARTH'S HISTORY

Theme/Questions	K-2	3-5	6-8	9-12
How has the Earth changed through time? What is our evidence for the Earth's changes?	The Earth is very old.	The Earth is very old.	The Earth is ~4.6 billion years old. The long history of Earth is displayed in its rocks. The sequence and composition of rocks gives us their relative and absolute ages.	The Earth is ~4.6 billion years old. The long history of Earth is displayed in its rocks. Evidence for the age and geologic activities of the Earth includes: rock sequence, radioactive isotopes, magnetic reversals, and fossil correlations.
	The Earth's surface changes.	The Earth's surface has changed over time.	The atmosphere, lithosphere, hydrosphere and biosphere have changed over time.	The atmosphere, lithosphere, hydrosphere and biosphere have changed over time.
		Landmasses have moved and are still moving. Some changes take a long time.	The continents and oceans have not always been in their present positions.	Plate tectonics cause changes in continent and ocean configuration, resulting in changes in the atmosphere and biosphere.
			Geological change and biological evolution are linked	Geological change and biological evolution are linked.
	Life has been on Earth a long time.	Life has been on Earth for a very long time.	Life has been on Earth for billions of years.	Life has been on Earth for billions of years.
		Plants and animals have changed through time.	Life forms have continued to change and diversify through time. Life forms of the past were in some ways very different from living forms of today, but in other ways very similar. Most species that once lived on Earth have gone extinct.	Life forms have continued to change and diversify over time. Present-day species evolved from earlier species. During the course of evolution, only a small percentage of species have survived to today.
	Many animals, like dinosaurs, are now extinct.	Many life forms have gone extinct.		
	Fossils are evidence of animals and plants that lived a long time ago.	Fossils provide evidence of these changes.	Fossils provide evidence for how life and environmental conditions have changed. The relative age of fossils is reflected in the sequence of the rock layers in which they are found.	Fossils provide evidence for how life and environmental conditions have changed. The relative age of fossils is reflected in the sequence of the rock layers in which they are found.
			The composition of the atmosphere has changed as life forms have evolved.	The composition of the atmosphere has changed as life forms have evolved.
			Tectonic plate movement has affected the distribution of living things.	Tectonic plate movement has affected the distribution of living things.

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EARTH'S HISTORY (continued)

	K-2	3-5	6-8	9-12
			We divide Earth's history into time periods based on major biological and physical events and changes.	We divide Earth's history into time periods based on major biological and physical events and changes.

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NATURE OF SCIENCE

Theme/Questions	K-2	3-5	6-8	9-12
How does science try to explain the natural world?	Science tries to explain the natural world using evidence from the natural world.	Science tries to explain the natural world using evidence from the natural world.	Science tries to explain the natural world using evidence from the natural world.	Science attempts to explain the natural world using evidence from the natural world; this distinguishes science from non-science.
How do scientists gather evidence?	We learn about the natural world using our senses and extensions of our senses.	We learn about the natural world using our senses and extensions of our senses	Science assumes that we can learn about the natural world using our senses and extensions of our senses.	Science assumes that we can learn about the natural world using our senses and extensions of our senses.
			Scientific ideas and explanations are developed through reasoning. Theories and hypotheses are central to scientific thinking.	Scientific ideas and explanations are developed through reasoning. Theories and hypotheses are central to scientific thinking.
			Science does not prove or conclude; science is always a work in progress.	Science does not prove or conclude; science is always a work in progress.
				Scientific claims are subject to peer review and replication.
	Scientists work to create and answer questions.	Scientists work to create and answer questions.	Scientists pose, test, and revise hypotheses based on research outcomes.	Scientists pose, test, and revise multiple hypotheses to explain what they observe.
		Scientists work through careful observations and recording of those observations.	Scientists use only natural causes to explain natural phenomena.	Scientists use only natural causes to explain natural phenomena.
	Scientists study rocks. Scientists study changes in weather. Scientists study living things. Scientists study fossils.	Scientists study rocks and how and when they were formed. Scientists study landforms and how and when they were formed. Scientists study changes in weather and water systems. Scientists study living things and their environments. Scientists study fossils and how and when they were formed.	Scientists study the long-term and short-term changes in the Earth's spheres. Scientists use multiple lines of evidence to study the Earth and its history.	Scientists study the long-term and short-term changes in the Earth's spheres. Scientists use multiple lines of evidence to study the Earth and its history.

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