

Correlation to Utah Science Core Curriculum

Introduction to Earth and Space Science

Student Text and Investigation Manual

Standard #: Curriculum	Standard	Objective	Indicator	student text pg	detail	investigation pg	detail
ess.I.1.a Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Describe the big bang theory and evidence supporting it.	Determine the motion of a star relative to Earth based on a red or blue shift in the wavelength of light from the star.	213	death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs	88	using spectroscopy to analyze the light emitted by stars and identify most common elements
				214	death of massive stars results in supernovas and neutron stars and black holes		
				222	evidence for the Big Bang theory		
				223	evidence for the Big Bang theory		
ess.I.1.b Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Describe the big bang theory and evidence supporting it.	Explain how evidence of red and blue shifts is used to determine whether the universe is expanding or contracting.	213	death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs	88	using spectroscopy to analyze the light emitted by stars and identify most common elements
				214	death of massive stars results in supernovas and neutron stars and black holes		
				222	evidence for the Big Bang theory		
				223	evidence for the Big Bang theory		
ess.I.1.c Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Describe the big bang theory and evidence supporting it.	Describe the big bang theory and the red shift evidence that supports this theory.	222	evidence for the Big Bang theory	92	calculating the distance to stars and galaxies using apparent brightness and absolute brightness
				223	evidence for the Big Bang theory		

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ess.I.1.d Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Describe the big bang theory and evidence supporting it.	Investigate and report how science has changed the accepted ideas regarding the nature of the universe throughout history.	185 186 195 221	historical theories of the origin of the moon historical theories about the solar system historical theories of which objects were planets the Big Bang theory of the origin of the universe		
ess.I.1.e Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Describe the big bang theory and evidence supporting it.	Provide an example of how technology has helped scientists investigate the universe.	168 169 170 171 172 208	history of the telescope types and uses of telescopes types and uses of telescopes satellites as tools of astronomy spacecraft as tools of astronomy the use of spectroscopy to analyze stars	88 92	understand why spectroscopy is an important tool of astronomers measuring apparent brightness to calculate the distance to stars and galaxies
ess.I.2.a Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Compare the elements formed in the big bang (hydrogen, helium) with elements formed through nuclear fusion in stars.	214 214	death of massive stars birth of elements	88 91	light emission and chemical composition spectral lines and elements

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ess.I.2.b Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Relate the life cycle of stars of various masses to the relative mass of elements produced.	212 213 214	the life cycle of stars description and illustration of the life cycle of stars elements formed by nuclear fusion in stars	79	observe and describe the appearance of the moon and Jupiter and its moons
ess.I.2.c Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Explain the origin of the heavy elements on Earth (i.e., heavy elements were formed by fusion in ancient stars).	214 214	death of massive stars birth of elements	88 91	light emission and chemical composition spectral lines and elements
ess.I.2.d Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Present evidence that the process that formed Earth's heavy elements continues in stars today.	212 213 214 214 214	the life cycle of stars description and illustration of the life cycle of stars elements formed by nuclear fusion in stars death of massive stars birth of elements	79 88 91	observe and describe the appearance of the moon and Jupiter and its moons light emission and chemical composition spectral lines and elements
ess.I.2.e Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Compare the life cycle of the sun to the life cycle of other stars.	189 198 199	classifying the planets features and diagram of the sun features and emissions of the sun		

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ess.I.2.f Earth Systems Science	Students will understand the scientific evidence that supports theories that explain how the universe and solar system developed.	Relate the structure and composition of the solar system to the processes that exist in the universe.	Relate the structure of the solar system to the forces acting upon it.	186	Johannes Kepler	80	simulate an object in orbit and investigate how orbital period varies within distance
				186	orbits of planets around the sun	82	setting up a scale model of the solar system
				187	Kepler's elliptically shaped orbits	83	determining scale distances for the planets
				187	explanation and illustration of the solar system	84	determining scale sizes of the planets
				188	relative sizes and distances within the solar system		
				190	classifying the planets		
				191	classifying the planets		
				192	comparing properties of the planets		
				193	asteroids and comets		
				194	meteors and meteorites and the Kuiper Belt		
				195	is Pluto a planet		

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ess.II.1.a Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Describe the unique physical features of Earth's environment that make life on Earth possible.	Compare Earth's atmosphere, solar energy, and water to those of other planets and moons in the solar system.	24 186 186 187 189 193 194	comparison of Earth's atmosphere to other planets Johannes Kepler orbits of planets around the sun Kepler's elliptically shaped orbits what makes Earth capable of supporting life asteroids and comets meteors and meteorites and the Kuiper Belt	80	simulate an object in orbit and investigate how orbital period varies within distance
ess.II.1.b Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Describe the unique physical features of Earth's environment that make life on Earth possible.	Compare the conditions that currently support life on Earth to the conditions that exist on other planets in the solar system.	24 189	comparison of Earth's atmosphere to other planets what makes Earth capable of supporting life		
ess.II.1.c Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Describe the unique physical features of Earth's environment that make life on Earth possible.	Evaluate evidence for existence of life in other star systems, planets, or moons, either now or in the past.	215	the existence of other planetary systems		

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ess.II.2.a Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Observe and list abiotic factors (e.g., temperature, water, nutrients, sunlight, pH, topography) in specific ecosystems.	23 23 32 33 50 53 81 84 133	composition of Earth's atmosphere nitrogen cycle distribution of incoming solar radiation Earth's "energy budget" phase changes in the atmosphere and dewpoint forms of precipitation effects of acid rain on natural environments oceans in the water cycle volcanoes and water vapor	14 33 40	detecting ozone which is a protective atmosphere gas against high energy radiation finding relative humidity actions to take to improve water quality
ess.II.2.b Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Observe and list biotic factors (e.g., plants, animals, organic matter) that affect a specific ecosystem (e.g., wetlands, deserts, aquatic).	61 63	descriptions and distribution of desert biomes descriptions and distribution of tropical rainforest biomes		

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ess.II.2.c Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Predict how an ecosystem will change as a result of major changes in an abiotic and/or biotic factor.	23	nitrogen cycle	40	actions to take to improve water quality
				31	effects of CFC's on the ozone layer	40	predict the quality of surface water to be tested and justify your answer
				34	effects of burning fossil fuels		
				34	changes to the oceans due to increasing global temperatures		
				61	descriptions and distribution of desert biomes		
				63	descriptions and distribution of tropical rainforest biomes		
				67	permafrost		
				81	effects of acid rain on natural environments		
				83	illustration of acid rain formation		
				87	impact of increased CO2 in oceans		
				142	how urban sprawl changes local climate		

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ess.II.2.d Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Explain that energy enters the vast majority of Earth's ecosystems through photosynthesis, and compare the path of energy through two different ecosystems.	32 33 61 63	distribution of incoming solar radiation Earth's "energy budget" descriptions and distribution of desert biomes descriptions and distribution of tropical rainforest biomes		

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ess.II.2.e Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Analyze interactions within an ecosystem (e.g., water temperature and fish species, weathering and water pH).	31	effects of CFC's on the ozone layer	40	predict the quality of surface water to be tested and justify your answer
				34	changes to the oceans due to increasing global temperatures	40	predict the quality of surface water to be tested and justify your answer
				34	effects of burning fossil fuels	41	address what you can do to maintain or improve the water quality at the test site
				67	permafrost		
				77	The Clean Water Act		
				79	water quality testing	44	investigate effect of acid rain on microorganisms
				80	water quality testing		
				81	acid rain explained	44	the effects of acid rain on organisms in aquatic environments
				81	effects of acid rain on the soil		
				81	acid rain		
				83	illustration of acid rain formation		
				87	impact of increased CO2 in oceans		
				87	impact of increased CO2 on oceans		
				88	pollution and the ocean food chain		
				89	pollution and the ocean food chain		
				92	research the issue of acid rain		

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				142	how urban sprawl changes local climate		

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ess.II.2.f Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Analyze how ecosystems differ from each other due to abiotic and biotic factors.	Plan and conduct an experiment to investigate how abiotic factors influence organisms and how organisms influence the physical environment.	23	nitrogen cycle	40	actions to take to improve water quality
				31	effects of CFC's on the ozone layer	40	predict the quality of surface water to be tested and justify your answer
				34	effects of burning fossil fuels	40	predict the quality of surface water to be tested and justify your answer
				34	changes to the oceans due to increasing global temperatures	41	address what you can do to maintain or improve the water quality at the test site
				56	temperature inversion	44	the effects of acid rain on organisms in aquatic environments
				67	permafrost		
				77	The Clean Water Act	44	the effects of acid rain on organisms in aquatic environments
				79	water quality testing		
				80	water quality testing	44	the effects of acid rain on organisms in aquatic environments
				81	acid rain		
				81	effects of acid rain on natural environments	44	the effects of acid rain on organisms in aquatic environments
				81	effects of acid rain on the soil		
				81	acid rain	44	the effects of acid rain on organisms in aquatic environments
				82	causes and health effects of acid rain		
				83	illustration of acid rain formation	44	the effects of acid rain on organisms in aquatic environments
				87	impact of increased CO2 on oceans		
				87	impact of increased CO2 in oceans	44	the effects of acid rain on organisms in aquatic environments

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				87	impact of increased CO2 on oceans		
				88	pollution and the ocean food chain		
				89	pollution and the ocean food chain		
				142	how urban sprawl changes local climate		
				142	environmental impact of urban sprawl		
ess.II.3.a Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Examine Earth's diversity of life as it changes over time.	Observe and chart the diversity in a specific area.	61	descriptions and distribution of desert biomes		
				63	descriptions and distribution of tropical rainforest biomes		
ess.II.3.b Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Examine Earth's diversity of life as it changes over time.	Compare the diversity of life in various biomes specific to number of species, biomass, and type of organisms.	61	descriptions and distribution of desert biomes		
				63	descriptions and distribution of tropical rainforest biomes		

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ess.II.3.c Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Examine Earth's diversity of life as it changes over time.	Explain factors that contribute to the extinction of a species.	97 98 98 140 193	faunal succession extinction of the dinosaurs due to giant meteor hitting Earth table and description of the geologic time scale ice ages how an asteroid event may have caused the extinction of dinosaurs		
ess.II.3.d Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Examine Earth's diversity of life as it changes over time.	Compare evidence supporting various theories that explain the causes of large-scale extinctions in the past with factors causing the loss of species today.	98 140	table and description of the geologic time scale ice ages		

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ess.II.3.e Earth Systems Science	Students will understand that the features of Earth's evolving environment affect living systems, and that life on Earth is unique in the solar system.	Examine Earth's diversity of life as it changes over time.	Evaluate the biological, esthetic, ethical, social, or economic arguments with regard to maintaining biodiversity.	76 77 79 80 81 92 92	water cycle and conservation wise use of water water usage and quality effect of excess nitrates on environment acid rain explained research economic impact of producing gases that cause acid rain research the issue of acid rain	17 40 41 42 42 44	research the causes of ozone in the lower atmosphere wise use of water supply maintaining water supply quality save water for houseplants perform water quality tests investigate effect of acid rain on microorganisms
ess.III.1.a Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Explain the evidence that supports the theory of plate tectonics.	Define and describe the location of the major plates and plate boundaries.	107 108 109 110	describing plate boundaries divergent plate boundaries convergent plate boundaries transform plate boundaries	53	identifying tectonic plates and plate boundaries
ess.III.1.b Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Explain the evidence that supports the theory of plate tectonics.	Compare the movement and results of movement along convergent, divergent, and transform plate boundaries.	102 104 105 106	definition of plate tectonics sea-floor spreading and mid-ocean ridges magnetic patterns on the sea floor theory of plate tectonics	52	listing which kind of plate boundary is associated with each geologic feature

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ess.III.1.c Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Explain the evidence that supports the theory of plate tectonics.	Relate the location of earthquakes and volcanoes to plate boundaries.	102	predicting what Earth might look like in 50 million years	53	identifying tectonic plates and plate boundaries
				107	describing plate boundaries	54	predicting plate movement over 50 million years and the resultant land features
				108	divergent plate boundaries	61	finding a pattern of volcanoes related to the locations of plate boundaries
				108	land features resulting from divergent plate boundaries		
				109	resulting land features from subduction		
				109	convergent plate boundaries		
				110	transform plate boundaries		
				110	land features resulting from transform plate boundaries		
				121	predict separation of North America and Europe in 75 million years		
				122	predict effects of divergent plate boundaries on Great Rift Valley		
				125	structure of a volcano		
				128	figure showing structure of different types of volcanoes		
				129	formation of shield volcanoes due to hot spots		

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				130	formation of stratovolcanoes due to subduction		
				137	mountain-building		
				138	changes in land features due to erosion		
				140	effect of glaciers on land		
ess.III.1.d Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Explain the evidence that supports the theory of plate tectonics.	Explain Alfred Wegener's continental drift hypothesis, his evidence, and why it was not accepted in his time.	103	critiquing Wegener's theories of continental drift		
				186	early theories of the solar system		
ess.III.1.e Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Explain the evidence that supports the theory of plate tectonics.	Evaluate the evidence for the current theory of plate tectonics.	102	definition of plate tectonics	52	listing which kind of plate boundary is associated with each geologic feature
				104	sea-floor spreading and mid-ocean ridges		
				105	magnetic patterns on the sea floor		
				106	theory of plate tectonics		

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ess.III.2.a Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Describe the processes within Earth that result in plate motion and relate it to changes in other Earth systems.	Identify the energy sources that cause material to move within Earth.	99 100 126 129 132 137 138 139	formation of Earth's layers description of Earth's layers formation of magma in Earth's mantle formation of Hawaiian Islands due to volcanic activity volcanoes shape the Earth constructive process of mountain building the destructive process of erosion wind erosion	64 65	estimating the effects of meteor impacts on Earth identifying which geologic features on Earth were caused by meteors
ess.III.2.b Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Describe the processes within Earth that result in plate motion and relate it to changes in other Earth systems.	Model the movement of materials within Earth.	99 100 107 108 126 136 150	formation of Earth's layers description of Earth's layers activity of Earth's crust at plate boundaries balance of creating and consuming Earth's crust formation of magma in Earth's mantle constructive and destructive processes the rock cycle		

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ess.III.2.c Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Describe the processes within Earth that result in plate motion and relate it to changes in other Earth systems.	Model the movement and interaction of plates.	102 104 105 106	definition of plate tectonics sea-floor spreading and mid-ocean ridges magnetic patterns on the sea floor theory of plate tectonics	52	listing which kind of plate boundary is associated with each geologic feature
ess.III.2.d Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Describe the processes within Earth that result in plate motion and relate it to changes in other Earth systems.	Relate the movement and interaction of plates to volcanic eruptions, mountain building, and climate changes.	102 108 109 110 121 122 137 138 140	predicting what Earth might look like in 50 million years land features resulting from divergent plate boundaries resulting land features from subduction land features resulting from transform plate boundaries predict separation of North America and Europe in 75 million years predict effects of divergent plate boundaries on Great Rift Valley mountain-building changes in land features due to erosion effect of glaciers on land	54	predicting plate movement over 50 million years and the resultant land features

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ess.III.2.e Earth Systems Science	Students will understand that gravity, density, and convection move Earth's plates and this movement causes the plates to impact other Earth systems.	Describe the processes within Earth that result in plate motion and relate it to changes in other Earth systems.	Predict the effects of plate movement on other Earth systems.	102 106	definition of plate tectonics theory of plate tectonics		
ess.IV.1.a Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Explain the water cycle in terms of its reservoirs, the movement between reservoirs, and the energy to move water. Evaluate the importance of freshwater to the biosphere.	Identify the reservoirs of Earth's water cycle (e.g., ocean, ice caps/glaciers, atmosphere, lakes, rivers, biosphere, groundwater) locally and globally, and graph or chart relative amounts in global reservoirs.	84 84 133	supply of water to oceans oceans in the water cycle volcanoes and water vapor		
ess.IV.1.b Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Explain the water cycle in terms of its reservoirs, the movement between reservoirs, and the energy to move water. Evaluate the importance of freshwater to the biosphere.	Illustrate the movement of water on Earth and describe how the processes that move water (e.g., evaporation of water, melting of ice/snow, ocean currents, movement of water vapor by wind) use energy from the sun.	49 50 53 84 133 138	water in the atmosphere affects weather patterns phase changes in the atmosphere and dewpoint forms of precipitation oceans in the water cycle volcanoes and water vapor landforms shaped by water	33	finding relative humidity

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ess.IV.1.c Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Explain the water cycle in terms of its reservoirs, the movement between reservoirs, and the energy to move water. Evaluate the importance of freshwater to the biosphere.	Relate the physical and chemical properties of water to a water pollution issue.	77 79 80 81 87 88 89	The Clean Water Act water quality testing water quality testing acid rain impact of increased CO2 on oceans pollution and the ocean food chain pollution and the ocean food chain	40 41 44	predict the quality of surface water to be tested and justify your answer address what you can do to maintain or improve the water quality at the test site the effects of acid rain on organisms in aquatic environments

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ess.IV.1.d Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Explain the water cycle in terms of its reservoirs, the movement between reservoirs, and the energy to move water. Evaluate the importance of freshwater to the biosphere.	Make inferences about the quality and/or quantity of freshwater, using data collected from local water systems.	31	effects of CFC's on the ozone layer	40	predict the quality of surface water to be tested and justify your answer
				34	effects of burning fossil fuels	40	predict the quality of surface water to be tested and justify your answer
				67	permafrost		
				77	The Clean Water Act	41	address what you can do to maintain or improve the water quality at the test site
				77	water quality standards		
				78	importance of water analysis	44	the effects of acid rain on organisms in aquatic environments
				79	water quality testing		
				80	water quality testing		
				81	acid rain		
				87	impact of increased CO2 in oceans		
				87	impact of increased CO2 on oceans		
				88	pollution and the ocean food chain		
				89	pollution and the ocean food chain		

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ess.IV.1.e Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Explain the water cycle in terms of its reservoirs, the movement between reservoirs, and the energy to move water. Evaluate the importance of freshwater to the biosphere.	Analyze how communities deal with water shortages, distribution, and quality in designing a long-term water use plan.	23 31 34 67 77 78 81 87	nitrogen cycle effects of CFC's on the ozone layer effects of burning fossil fuels permafrost water quality standards importance of water analysis effects of acid rain on natural environments impact of increased CO2 in oceans	40 40	actions to take to improve water quality predict the quality of surface water to be tested and justify your answer
ess.IV.2.a Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Analyze the physical and biological dynamics of the oceans.	Describe the physical dynamics of the oceans (e.g., wave action, ocean currents, El Nino, tides).	48 60	descriptions of ocean currents and their effects on climate causes and effects of the El Nino Southern Oscillation	23 31	research how large bodies of water affect climate understanding the Atlantic gyre
ess.IV.2.b Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Analyze the physical and biological dynamics of the oceans.	Determine how physical properties of oceans affect organisms (e.g., salinity, depth, tides, temperature).	84 85 86	supply of water to oceans sources of salts in the ocean composition of seawater	28	investigate how the ocean's salinity affects its density

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ess.IV.2.c Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Analyze the physical and biological dynamics of the oceans.	Model energy flow in ocean ecosystems.	84	supply of water to oceans		
ess.IV.2.d Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Analyze the physical and biological dynamics of the oceans.	Research and report on changing ocean levels over geologic time, and relate changes in ocean level to changes in the water cycle.	49 84 138	water in the atmosphere affects weather patterns supply of water to oceans landforms shaped by water		
ess.IV.2.e Earth Systems Science	Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.	Analyze the physical and biological dynamics of the oceans.	Describe how changing sea levels could affect life on Earth.	34 83 142	changes to the oceans due to increasing global temperatures illustration of acid rain formation how urban sprawl changes local climate		
ess.V.1.a Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Describe how matter in the atmosphere cycles through other Earth systems.	Trace movement of a carbon atom from the atmosphere through a plant, animal, and decomposer, and back into the atmosphere.	82	chemical reactions and the formation of acid rain		

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Standard #: Curriculum	Standard	Objective	Indicator	student text pg	detail	investigation pg	detail
ess.V.1.b Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Describe how matter in the atmosphere cycles through other Earth systems.	Diagram the nitrogen cycle and provide examples of human actions that affect this cycle (e.g., fertilizers, crop rotation, fossil fuel combustion).	23 81	nitrogen cycle effects of acid rain on natural environments	40	actions to take to improve water quality
ess.V.1.c Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Describe how matter in the atmosphere cycles through other Earth systems.	Interpret evidence suggesting that humans are influencing the carbon cycle.	23 33 81	nitrogen cycle greenhouse effect and greenhouse gasses effects of acid rain on natural environments	18 40 47	investigate the temperature effects of greenhouse gases actions to take to improve water quality effect of ocean on carbon dioxide levels in the atmosphere

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ess.V.1.d Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Describe how matter in the atmosphere cycles through other Earth systems.	Research ways the biosphere, hydrosphere, and lithosphere interact with the atmosphere (e.g., volcanic eruptions putting ash and gases into the atmosphere, hurricanes, changes in vegetation).	34	changes to the oceans due to increasing global temperatures	23	research how large bodies of water affect climate
				43	Earth's temperature varies with latitude	60	understanding the Volcanic Explosivity Index
				48	effects of the Gulf Stream on climate of Great Britain		
				62	effect of cold ocean currents on formation of fog deserts		
				63	effect of warm ocean currents on formation of tropical rainforest		
				65	effect of large bodies of water on climate		
				67	alpine tundra occurs at high altitudes		
				83	illustration of acid rain formation		
				128	types and shapes of volcanoes		
				129	shield volcanoes		
				130	stratovolcanoes		
				142	how urban sprawl changes local climate		

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ess.V.2.a Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Trace ways in which the atmosphere has been altered by living systems and has itself strongly affected living systems over the course of Earth's history.	Define ozone and compare its effects in the lower and upper atmosphere.	23 35 37 102	composition of Earth's atmosphere global temperature changing over time computer modeling to predict greenhouse effects Earth's surface is changing	14	detecting ozone which is a protective atmosphere gas against high energy radiation
ess.V.2.b Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Trace ways in which the atmosphere has been altered by living systems and has itself strongly affected living systems over the course of Earth's history.	Describe the role of living organisms in producing the ozone layer and how the ozone layer affected the development of life on Earth.	23	composition of Earth's atmosphere	14	detecting ozone which is a protective atmosphere gas against high energy radiation
ess.V.2.c Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Trace ways in which the atmosphere has been altered by living systems and has itself strongly affected living systems over the course of Earth's history.	Compare the rate at which CO ₂ is put into the atmosphere to the rate at which it is removed through the carbon cycle.	23 81	nitrogen cycle effects of acid rain on natural environments	40	actions to take to improve water quality

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ess.V.2.d Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Trace ways in which the atmosphere has been altered by living systems and has itself strongly affected living systems over the course of Earth's history.	Analyze data relating to the concentration of atmospheric CO ₂ over the past 100 years.	33	greenhouse effect and greenhouse gasses	18 47	investigate the temperature effects of greenhouse gases effect of ocean on carbon dioxide levels in the atmosphere
ess.V.2.e Earth Systems Science	Students will understand that Earth's atmosphere interacts with and is altered by the lithosphere, hydrosphere, and biosphere.	Trace ways in which the atmosphere has been altered by living systems and has itself strongly affected living systems over the course of Earth's history.	Research, evaluate, and report on international efforts to protect the atmosphere.	56 80 81 82 87	temperature inversion effect of excess nitrates on environment acid rain causes and health effects of acid rain impact of increased CO ₂ on oceans	44	the effects of acid rain on organisms in aquatic environments
ess.VI.1.a Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Illustrate the distribution of energy coming from the sun that is reflected, changed into heat, or stored by plants.	32 33 37	distribution of incoming solar radiation Earth's "energy budget" Earth's internal energy		

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ess.VI.1.b Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Describe the pathways for converting and storing light energy as chemical energy (e.g., light energy converted to chemical energy stored in plants, plants become fossil fuel).	32 33	distribution of incoming solar radiation Earth's "energy budget"		
ess.VI.1.c Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Investigate the conversion of light energy from the sun into heat energy by various Earth materials.	32 33 37	distribution of incoming solar radiation Earth's "energy budget" Earth's internal energy		

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ess.VI.1.d Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Demonstrate how absorbed solar energy eventually leaves the Earth system as heat radiating to space.	14 14 15 15 16 17 17 32 33 34 37 45	heat transfer through air densely packed solids are good conductors of heat convection currents and weather warming hands over candle convection currents in water solid road surface emits radiation transfer of heat by radiation distribution of incoming solar radiation Earth's "energy budget" global warming and heat transfer by radiation Earth's internal energy apply knowledge of heat transfer to different situations	8	investigate convection in liquids
ess.VI.1.e Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Construct a model that demonstrates the reduction of heat loss due to a greenhouse effect.	33	greenhouse effect and greenhouse gasses	18 47	investigate the temperature effects of greenhouse gases effect of ocean on carbon dioxide levels in the atmosphere

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ess.VI.1.f Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Describe the transformation of solar energy into heat and chemical energy on Earth and eventually the radiation of energy to space.	Research global changes and relate them to Earth systems (e.g., global warming, solar fluctuations).	31	effects of CFC's on the ozone layer	23	research how large bodies of water affect climate
				33	global warming	23	research how large bodies of water affect climate
				34	effects of burning fossil fuels	29	exploring how temperature-dependent layering creates currents
				37	computer modeling to predict greenhouse effects	31	understanding the Atlantic gyre
				43	Earth's temperature varies with latitude	40	predict the quality of surface water to be tested and justify your answer
				45	convection currents in the atmosphere		
				46	the Coriolis effect		
				47	global wind patterns		
				48	descriptions of ocean currents and their effects on climate		
				48	effects of the Gulf Stream on climate of Great Britain		
				54	cold fronts		
				54	effects of moving air masses		
				55	jet streams		
				55	warm fronts		
				56	rotation of air masses due to Coriolis effect		
				62	effect of cold ocean currents on formation of fog desserts		

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				63	effect of warm ocean currents on formation of tropical rainforest		
				65	effect of large bodies of water on climate		
				67	alpine tundra occurs at high altitudes		
				67	permafrost		
				87	impact of increased CO2 in oceans		

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ess.VI.2.a Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Relate energy sources and transformation to the effects on Earth systems.	Describe the difference between climate and weather, and how technology is used to monitor changes in each.	3	thermometers	10	construct and use an aneroid barometer
				4	thermometers	2	accurately measuring temperature using thermometers
				26	measuring atmospheric pressure with barometers	23	research how large bodies of water affect climate
				32	transfer of energy in and out of Earth's atmosphere	23	research how large bodies of water affect climate
				37	computer modeling to predict greenhouse effects	31	understanding the Atlantic gyre
				43	Earth's temperature varies with latitude	34	using Doppler radar images to detect and track storms
				47	global wind patterns	35	use radar to detect a tornado
				48	effects of the Gulf Stream on climate of Great Britain	36	using radar to track a hurricane
				48	descriptions of ocean currents and their effects on climate		
				49	sling psychrometer		
				49	factors which influence the weather		
				51	cloud formation		
				54	effects of moving air masses		
				54	cold fronts		
				55	jet streams		
				55	warm fronts		
				57	description of thunderstorms		
				58	description of hurricanes		

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				59	description of tornadoes		
				62	effect of cold ocean currents on formation of fog deserts		
				63	effect of warm ocean currents on formation of tropical rainforest		
				65	effect of large bodies of water on climate		
				67	alpine tundra occurs at high altitudes		
ess.VI.2.b Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Relate energy sources and transformation to the effects on Earth systems.	Describe the effect of solar energy on the determination of climate and weather (e.g., El Nino, solar intensity).	44	Earth's tilt causes seasons	25	investigating factors which cause the seasons
				45	convection currents in the atmosphere	29	exploring how temperature-dependent layering creates currents
				47	global wind patterns		
				54	effects of moving air masses		
				54	cold fronts		
				55	jet streams		
				55	warm fronts		
				60	causes and effects of the El Nino Southern Oscillation		
				70	create a model to explain why Earth has seasons		

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ess.VI.2.c Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Relate energy sources and transformation to the effects on Earth systems.	Explain how uneven heating at the equator and polar regions creates atmospheric and oceanic convection currents that move heat energy around Earth.	45	convection currents in the atmosphere	29	exploring how temperature-dependent layering creates currents
ess.VI.2.d Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Relate energy sources and transformation to the effects on Earth systems.	Describe the Coriolis effect and its role in global wind and ocean current patterns.	46 56	the Coriolis effect rotation of air masses due to Coriolis effect		

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ess.VI.2.e Earth Systems Science	Students will understand the source and distribution of energy on Earth and its effects on Earth systems.	Relate energy sources and transformation to the effects on Earth systems.	Relate how weather patterns are the result of interactions among ocean currents, air currents, and topography.	47	global wind patterns	23	research how large bodies of water affect climate
				48	descriptions of ocean currents and their effects on climate	31	understanding the Atlantic gyre
				49	water in the atmosphere affects weather patterns	35	use radar to detect a tornado
				49	factors which influence the weather	36	using radar to track a hurricane
				51	cloud formation		
				54	effects of moving air masses		
				54	cold fronts		
				55	jet streams		
				55	warm fronts		
				57	description of thunderstorms		
				58	description of hurricanes		
				59	description of tornadoes		