Correlation to NRC National Science Education Standards with Inquiry

Introduction to Earth and Space Science

Student Text and Investigation Manual

Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES01.01 Earth and Space Science	Energy in the Earth System	Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy…	32	distribution of incoming solar radiation		
			33	Earth's "energy budget"		
			37	Earth's internal energy		
			197	energy from the sun		
			200	harnessing the sun's energy		

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Student Text and Investigation Manual

Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES01.02 Earth and Space Science	Energy in the Earth System	The outward transfer of the earth's internal heat drives convection circulation in the mantle that propels the plates comprising earth's surface across the face of the globe.	14	densely packed solids are good conductors of heat	52	listing which kind of plate boundary is associated with each geologic feature
			14	heat transfer through air	53	identifying tectonic plates and plate boundaries
			15	warming hands over candle	8	investigate heat transfer through a liquid by natural convection
			15	convection currents and weather	8	investigate convection in liquids
			16	convection currents in water	9	investigate heat transfer through a liquid by forced convection
			17	transfer of heat by radiation		
			17	solid road surface emits radiation		
			34	global warming and heat transfer by radiation		
			45	apply knowledge of heat transfer to different situations		
			99	convection inside Earth		
			102	definition of plate tectonics		
			104	sea-floor spreading and mid-ocean ridges		
			105	magnetic patterns on the sea floor		
			106	theory of plate tectonics		
			107	describing plate boundaries		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
			108	divergent plate boundaries		
			109	convergent plate boundaries		
			110	transform plate boundaries		
ES01.03 Earth and Space Science	Energy in the Earth System	Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.	45	convection currents in the atmosphere	29	exploring how temperature-dependent layering creates currents

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES01.04 Earth and Space Science	Energy in the Earth System	Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions...	32	distribution of incoming solar radiation	23	research how large bodies of water affect climate
			32	transfer of energy in and out of Earth's atmosphere	39	research a particular biome
			33	Earth's "energy budget"		
			43	Earth's temperature varies with latitude		
			46	the Coriolis effect		
			47	global wind patterns		
			48	effects of the Gulf Stream on climate of Great Britain		
			54	effects of moving air masses		
			54	cold fronts		
			55	warm fronts		
			55	jet streams		
			56	rotation of air masses due to Coriolis effect		
			62	effect of cold ocean currents on formation of fog desserts		
			62	different types of deserts and how they are formed		
			63	how tropical rainforests are formed		
			63	effect of warm ocean currents on formation of tropical rainforest		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
			65	effect of large bodies of water on climate		
			67	alpine tundra occurs at high altitudes		
ES02.01 Earth and Space Science	Geochemical Cycles	The earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs. Each element on earth moves among reservoirs in the solid earth, oceans, atmosphere…	84	oceans in the water cycle		
			133	volcanoes and water vapor		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES02.02 Earth and Space Science	Geochemical Cycles	Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example…	23	nitrogen cycle	40	actions to take to improve water quality
			81	effects of acid rain on natural environments		
			138	landforms shaped by water		
ES03.01 Earth and Space Science	The Origin and Evolution of the Earth System	The sun, the earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago. The early earth was very different from the planet we live on today.	185	historical theories of the origin of the moon		
			186	historical theories about the solar system		
			195	historical theories of which objects were planets		
			221	the Big Bang theory of the origin of the universe		
			222	evidence for the Big Bang theory		
			223	evidence for the Big Bang theory		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES03.02 Earth and Space Science	The Origin and Evolution of the Earth System	Geologic time can estimated by observing rock sequences and using fossils to correlate the sequences at various locations. Current methods include using the known decay rates of radioactive isotopes present in rocks…	96	relative dating	49	determining the relative ages of rock formations
			97	interpreting rock formations	50	sequencing events in a geologic cross-section
			97	faunal succession		
			143	studying moon rocks on Earth		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES03.03 Earth and Space Science	The Origin and Evolution of the Earth System	Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale…	23	nitrogen cycle	40	predict the quality of surface water to be tested and justify your answer
			31	effects of CFC's on the ozone layer	40	actions to take to improve water quality
			33	global warming	54	predicting plate movement over 50 million years and the resultant land features
			34	effects of burning fossil fuels	64	estimating the effects of meteor impacts on Earth
			34	changes to the oceans due to increasing global temperatures	65	identifying which geologic features on Earth were caused by meteors
			67	permafrost		
			81	effects of acid rain on natural environments		
			83	illustration of acid rain formation		
			87	impact of increased CO2 in oceans		
			98	table and description of the geologic time scale		
			102	definition of plate tectonics		
			102	predicting what Earth might look like in 50 million years		
			106	theory of plate tectonics		
			108	land features resulting from divergent plate boundaries		
			109	resulting land features from subduction		

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Standard #: Topic Fundamental Concept Content Area	student text pg	detail	investigation pg	detail
	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		
	129	formation of Hawaiian Islands due to volcanic activity		
	132	volcanoes shape the Earth		
	136	constructive and destructive processes		
	137	constructive process of mountain building		
	137	mountain-building		
	138	the destructive process of erosion		
	138	changes in land features due to erosion		
	139	formation of soil		
	139	wind erosion		
	140	ice ages		
	140	effect of glaciers on land		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
			142	environmental impact of urban sprawl		
			142	how urban sprawl changes local climate		
			150	the rock cycle		
ES03.04 Earth and Space Science	The Origin and Evolution of the Earth System	Evidence for one-celled forms of life--the bacteria--extends back more than 3.5 billion years. The evolution of life caused dramatic changes in the composition of the earth's atmosphere, which did not originally contain oxygen.	24	comparison of Earth's atmosphere to other planets		
			98	table and description of the geologic time scale		
			140	ice ages		
			189	what makes Earth capable of supporting life		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES04.01 Earth and Space Science	The Origin and Evolution of the Universe	The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state: according to this theory…	185	historical theories of the origin of the moon		
			186	historical theories about the solar system		
			195	historical theories of which objects were planets		
			221	the Big Bang theory of the origin of the universe		
			222	evidence for the Big Bang theory		
			223	evidence for the Big Bang theory		
ES04.02 Earth and Space Science	The Origin and Evolution of the Universe	Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitational bound cluster…	212	the life cycle of stars	79	observe and describe the appearance of the moon and Jupiter and its moons
			213	description and illustration of the life cycle of stars		
			214	elements formed by nuclear fusion in stars		
			215	how the solar system was formed		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
ES04.03 Earth and Space Science	The Origin and Evolution of the Universe	Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.	214 214	birth of elements death of massive stars	88 91	light emission and chemical composition spectral lines and elements

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ01.1 Inquiry	Abilities Necessary to do Scientific Inquiry	Identify questions and concepts that guide scientific investigations	3	what is temperature	21	investigating how specific heat of water regulates Earth's temperature
			8	asking questions pertaining to specific heat and heat flow	4	conducting investigation of efficiency of immersion heater
			24	why is Earth's atmosphere different from other planets	44	simulating the effect of acid rain on daphnia
			25	why do ears pop	57	identifying how the earthquake model represents an earthquake
			44	why does Earth have seasons	9	conducting experiments on heat transfer
			53	how does rain form		
			61	how do animals survive in the desert		
			67	what is a carbon sink		
			73	why haven't we run out of water		
			78	what is in your tap water		
			81	what is acid rain		
			85	why are oceans salty		
			108	why doesn't Earth get bigger and bigger		
			162	what causes eclipses		
			195	is Pluto a planet		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ01.2 Inquiry	Abilities Necessary to do Scientific Inquiry	Design and conduct scientific investigations	4	safety caution on heating jar	10	design and construct an aneroid barometer
			8	determining effect of changing mass on temperature changes	13	identifying relationships between air pressure and weather
			12	thermal equilibrium	14	making qualitative observations of the amount of ozone present in the school environment
			49	factors that shape the weather	15	collecting Schönbein strips for detecting ozone
			82	what causes acid rain	16	evaluating your qualitative ozone strips
			182	relationship between orbital speed and distance between two objects	17	researching the causes of ozone
			201	research space solar power	18	safety in greenhouse gas investigation
					18	collecting data of temperature and sensations
					2	thermometer safety
					21	investigating how specific heat of water regulates Earth's temperature
					22	collecting temperature and time data
					22	identifying relationship between percent of Earth covered in water and temperature range

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Standard #: Topic Fundamental Concept Content Area	student text pg	detail	investigation pg	detail
			23	researching how bodies of water affect climate
			24	testing hypothesis of why seasons occur against your observations in the investigation
			25	measuring the intensity of light using an electric meter and solar cell and light bulb
			26	collecting qualitative data of light intensity at scale distance from the sun
			26	safety using light bulbs
			27	determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
			32	safety in swinging thermometers
			33	collecting wet and dry bulb temperature readings
			38	researching an animal that is adapted to live in the biome you studied
			4	conducting investigation of efficiency of immersion heater
			4	heat safety

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Standard #: Topic Fundamental Concept Content Area	student text pg	detail	investigation pg	detail
			40	visit local water supply and perform testing
			42	researching where your water comes from
			42	safety tip for water testing
			44	simulating the effect of acid rain on daphnia
			44	making hypotheses and testing them against observations
			44	safety tips for observing Daphnia
			44	observing daphnia and recording movements and behavior
			47	analyzing the results of the buffered acid experiment
			48	reconstruct a series of events from clues
			48	sequencing events
			51	researching forensic science
			57	identifying how the earthquake model represents an earthquake

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
					59	concluding which conditions affect the timeing and duration and intensity of an earthquake based on observation
					59	interpreting how the drumming affects the intensity of the earthquake in the model
					6	effect of changing mass on data
					6	effect of changing mass on collected data
					61	develop a research plan for studying volcanoes
					65	justify which scenario was most likely
					67	recording observations of crystal growing
					75	recording the changes in the moon over a month
					76	identifying the parts of a refracting telescope and making observations of the moon's surface
					8	heat safety
					80	investigation discovering relationship between orbital speed and distance
					80	safety in lab

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
					9	conducting experiments on heat transfer
					9	explaining efficiency of heat transfer based on data
					vi	safety in the laboratory

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ01.3 Inquiry	Abilities Necessary to do Scientific Inquiry	Use technology and mathematics to improve investigations and communications			13	calculating error between your barometer and a commercial barometer
					15	importance of good record keeping in order to avoid error
					2	measure temperature
					2	collecting temperature data
					3	find slope of a trend line
					33	determining relationship between temperature of the atmosphere and relative humidity
					34	interpreting Doppler radar images
					43	organize water quality data into a table
					44	making detailed observations
					46	collecting pH readings while adding carbon dioxide
					5	calculate slope of a graph
					5	collecting time and temperature data
					61	finding a pattern of volcanoes on a bathymetric map

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
					73	using your sundial to collect accurate data
					77	calibrating your telescope
					9	collecting and recording time and temperature data

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ01.4 Inquiry	Abilities Necessary to do Scientific Inquiry	Formulate and revise scientific explanations and models using logic and evidence	98	model of Earth's history	13	evaluating your aneroid barometer design
					13	constructing a graph from atmospheric pressure data
					18	modeling the effect of greenhouse gases on Earth's temperature
					19	graphing water and ice temperature readings
					22	constructing a graph of time vs. temperature
					28	modeling underwater rivers and waterfalls and springs
					3	find equation for trend line
					3	construct a graphical model
					47	constructing a graph of drops of acid vs pH
					5	construct a temperature vs. time graph
					55	evaluating your completed bathymetric map
					56	construct a model that simulates an earthquake
					71	evaluate your ability to interpret rock formations
					81	inverse square law

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
					82	setting up a scale model of the solar system
INQ01.5 Inquiry	Abilities Necessary to do Scientific Inquiry	Recognize and analyze alternative explanations and models	95	relative dating and modern geology based on Steno's theories		
			98	Kelvin's calculations of Earth's age		
			102	theory of plate tectonics		
			103	critiquing Wegener's theories of continental drift		
			137	Darwin's theories of the Andes formation		
			140	what causes ice ages		
			185	theories of origin of the moon		
			186	early theories of the solar system		
			221	Big Bang theory		
INQ01.6 Inquiry	Abilities Necessary to do Scientific Inquiry	Communicate and defend a scientific argument			41	create water quality report
					43	write paragraph to explain results
					45	writing up a lab report
					45	write summary of findings

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ02.1 Inquiry	Understandings About Scientific Inquiry	Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations…	7	contributions of Joule	14	contributions of Schönbein
			9	Joseph Black		
			20	research the history of heat and temperature		
			31	scientists detect loss of ozone in atmosphere		
			34	effects of global warming discovered		
			48	tracking ocean currents		
			63	trees and global climate		
			87	impact of carbon dioxide on life in the oceans		
			92	research local water supply history		
			116	studying seismic waves leads to information used in oil and gas exploration		
			119	predicting tsunamis		
			142	urban sprawl		
			157	history of calendars		
			159	counting the days in a year		
			160	the history of clocks and the division of time		
			163	ancient beliefs about solar eclipses		
			168	history of the telescope		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ02.2 Inquiry	Understandings About Scientific Inquiry	Scientists conduct investigations for a wide variety of reasons. For example, they may wish to discover new aspects of the natural world, explain recently observed phenomena, or test the conclusions of prior investigations or the predictions of current…	4	balloons expands or contracts due to thermal expansion		connecting the latent heat investigation to Earth 20
			6	temperature vs. thermal energy for a cup or pot of soup	13	evaluating the relationship between atmospheric pressure and weather
			13	understanding thermal energy through cocoa example	17	suggesting ways that ozone concentrations could be reduced
			15	convection and sea breezes	31	the food paradox of the oceans
			17	examples of reflectors and absorbers	34	understanding Doppler radar
			25	why do ears pop	41	researching and preparing for a field trip to test surface water
			25	why do ears pop		
			28	atmospheric pressure in Denver		
			41	patterns of heating and cooling on Earth		
			42	using the North Star to estimate your latitude		
			56	meteorologists use atmospheric pressure data to understand movement of weather systems		
			60	patterns in storm activity across the globe		
			61	how do animals survive in the desert		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
			107	patterns of earthquakes and volcanoes		
			110	analogy of plate movements		
			114	boundaries of tectonic plates		
			127	the Ring of Fire		
			158	lunar cycles		
			183	tides		
			211	categorizing stars with H-R diagrams		
			222	evidence for Big Bang theory		

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ02.3 Inquiry	Understandings About Scientific Inquiry	Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of..			2 2 44 46 5 73 77 9	collecting temperature data measure temperature making detailed observations collecting pH readings while adding carbon dioxide collecting time and temperature data using your sundial to collect accurate data calibrating your telescope collecting and recording time and temperature data
INQ02.4 Inquiry	Understandings About Scientific Inquiry	Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results.			3 81	find equation for trend line inverse square law

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Standard #: Content Area	Topic	Fundamental Concept	student text pg	detail	investigation pg	detail
INQ02.5 Inquiry	Understandings About Scientific Inquiry	Scientific explanations must adhere to criteria such as: a proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current…			16 17 20 63 66	evaluating your qualitative ozone strips predicting areas with high ozone concentration based on your data predicting what would happen if you place your ice/water test tube into a hot cup or a cold cup estimating the number of meteor collisions on Earth during the last 3.5 billion years predicting the results of the crystal-growing experiment
INQ02.6 Inquiry	Understandings About Scientific Inquiry	Results of scientific inquiry-new knowledge and methods-emerge from different types of investigations and public communication among scientists. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate…	98	model of Earth's history	18 28 56 82	modeling the effect of greenhouse gases on Earth's temperature modeling underwater rivers and waterfalls and springs construct a model that simulates an earthquake setting up a scale model of the solar system