

Correlation to Montana Standards for Science

Foundations of Physical Science with Earth and Space Science (Second Edition)

Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
ES4.1 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Understand the theory of plate tectonics and how it explains the interrelationship between earthquakes, volcanoes, and sea floor spreading	534	predicting what Earth might look like in 50 million years	228	listing which kind of plate boundary is associated with each geologic feature
				534	definition of plate tectonics	230	predicting plate movement over 50 million years and the resultant land features
				536	sea-floor spreading and mid-ocean ridges	240	estimating the effects of meteor impacts on Earth
				537	magnetic patterns on the sea floor	241	identifying which geologic features on Earth were caused by meteors
				538	theory of plate tectonics		
				540	land features resulting from divergent plate boundaries		
				541	resulting land features from subduction		
				542	land features resulting from transform plate boundaries		
				543	earthquakes and plate tectonics		
				553	predict separation of North America and Europe in 75 million years		
				554	predict effects of divergent plate boundaries on Great Rift Valley		
				558	formation of magma in Earth's mantle		
				558	geologic basis for volcanic eruptions		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				559	
					where volcanic activity occurs
				561	
					formation of Hawaiian Islands due to volcanic activity
				561	
					geologic basis for shield volcanoes
				562	
					geologic basis for stratovolcanoes
				563	
					geologic bases for cinder cone volcanoes
				564	
					volcanoes shape the Earth
				569	
					mountain-building
				569	
					constructive process of mountain building
				570	
					the destructive process of erosion
				570	
					changes in land features due to erosion
				571	
					wind erosion
				572	
					effect of glaciers on land

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
ES4.2 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Identify and classify rocks and minerals based on physical and chemical properties and the utilization by humans (e.g., natural resources, building materials)	301	relationship between mass volume and density	116	mass and volume measurements
				548	using seismic waves for oil and gas exploration	243	examine samples of granite, gabbro, rhyolite, and basalt
				566	mineral deposits and diamonds	245	examine samples of conglomerate and shale
				576	properties of minerals		
				577	common minerals		
				578	Mohs hardness scale		
ES4.3 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Explain scientific theories about how fossils are used as evidence of changes over time	527	origin of fossils	225	determining the relative ages of rock formations
				528	relative dating	226	sequencing events in a geologic cross-section
				528	relative dating		
				529	interpreting rock formations		
				529	faunal succession		
				530	calculating Earth's age		
				530	table and description of the geologic time scale		
				572	ice ages		
575	studying moon rocks on Earth						

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ES4.4 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Collect and analyze local and regional weather data to make inferences and predictions about weather patterns; explain factors influencing global weather and climate; and describe the impact on earth of fluctuations in weather and climate	445	illustration of acid rain formation	158	use a thermometer
				457	thermometers	186	accurately measuring temperature using thermometers
				458	thermometers	194	construct and use an aneroid barometer
				480	measuring atmospheric pressure with barometers	207	research how large bodies of water affect climate
				486	transfer of energy in and out of Earth's atmosphere	215	understanding the Atlantic gyre
				487	global warming	217	finding relative humidity
				488	changes to the oceans due to increasing global temperatures	218	using Doppler radar images to detect and track storms
				489	global temperature changing over time		
				491	computer modeling to predict greenhouse effects		
				502	descriptions of ocean currents and their effects on climate		
				503	slings psychrometer		
				503	slings psychrometer		
				504	phase changes in the atmosphere and dewpoint		
				507	forms of precipitation		
				534	Earth's surface is changing		
				574	how urban sprawl changes local climate		

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ES4.5 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Explain the impact of terrestrial, solar, oceanic, and atmosphere conditions on global climatic patterns	486	transfer of energy in and out of Earth's atmosphere	185	effect of ocean on carbon dioxide levels in the atmosphere
				487	greenhouse effect and greenhouse gasses	202	investigate the temperature effects of greenhouse gasses
				487	greenhouse conditions on Earth	207	research how large bodies of water affect climate
				491	Earth's internal energy	207	research how large bodies of water affect climate
				491	research the density of Venus' and Mars' atmospheres	207	research how large bodies of water affect climate
				497	Earth's temperature varies with latitude	213	exploring how temperature-dependent layering creates currents
				499	convection currents in the atmosphere	215	understanding the Atlantic gyre
				500	the Coriolis effect	223	research a particular biome
				501	global wind patterns		
				502	effects of the Gulf Stream on climate of Great Britain		
				502	descriptions of ocean currents and their effects on climate		
				508	effects of moving air masses		
				508	cold fronts		
				509	warm fronts		
				509	jet streams		
				510	rotation of air masses due to Coriolis effect		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				514	
					causes and effects of the El Nino Southern Oscillation
				515	
					descriptions and distribution of desert biomes
				516	
					effect of cold ocean currents on formation of fog deserts
				516	
					different types of deserts and how they are formed
				517	
					how tropical rainforests are formed
				517	
					descriptions and distribution of tropical rainforest biomes
				517	
					effect of warm ocean currents on formation of tropical rainforest
				519	
					effect of large bodies of water on climate
				521	
					alpine tundra occurs at high altitudes
				621	
					greenhouse conditions on Venus

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
ES4.6 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Describe the origin, location, and evolution of stars and their planetary systems in respect to the solar system, the milky way, the local galactic group, and the universe	597 characteristics of the universe 628 descriptions of the sun and comparisons to other stars 639 what is a star? 641 size of the sun compare to other stars 643 H-R diagrams comparing temperature and brightness of stars 645 death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs 646 death of massive stars results in supernovas and neutron stars and black holes 648 what is a galaxy? 649 the structure of the Milky Way Galaxy 658 research and describe astronomical objects	264 using spectroscopy to analyze the light emitted by stars and identify most common elements

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
ES4.7 9-12	Earth Science	Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and other objects in space	Relate how evidence from advanced technology applied to scientific investigations (e.g., large telescopes and spaceborne observatories), has dramatically impacted our understanding of the origin, size, and evolution of the universe	75	impact of Da Vinci's work	264	understand why spectroscopy is an important tool of astronomers
				600	history of the telescope		
				601	types and uses of telescopes	268	measuring apparent brightness to calculate the distance to stars and galaxies
				602	photo from the Very Large Array		
				602	types and uses of telescopes		
				603	satellites as tools of astronomy		
				604	spacecraft as tools of astronomy		
				617	historical theories of the origin of the moon		
				618	historical theories about the solar system		
				627	historical theories of which objects were planets		
				640	the use of spectroscopy to analyze stars		
				653	the Big Bang theory of the origin of the universe		

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Standard #: Grade	Topic	Content Standard	Benchmark		Volume 1 Student Text Page	Volume 2 Investigation Manual Page	
INQ1.1 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	Generate a question, identify dependent and independent variables, formulate testable, multiple hypotheses, plan an investigation, predict its outcome, safely conduct the scientific investigations and collect and analyze data.	7	experimentation begins with a question	4	difference between precise and accurate data
				9	steps in the scientific method	6	electronic timer and release technique
				10	forming a hypothesis	7	record time interval
				11	control and experimental variables	7	perform your own experiment
				12	importance of reliable and accurate data collection	7	doing a controlled experiment
				19	design your own experiment	7	compare results with hypothesis
				19	design your own experiment	7	design your own experiment
				20	finding variability in data	9	collect speed data
				24	interpretations of patterns in data	9	design three experiments using car and ramp
				26	independent and dependent variables	10	conduct car/ramp experiment
				27	reading a graph	11	calculate % error
				42	devise an experiment	14	record three different time intervals
				80	analyze lever diagram	15	interpret a speed vs. time graph
				81	look at force data and decide the usefulness of a machine	16	decide how to vary the force on the car for this experiment
				378	observe chemical changes	16	investigate Newton's 2nd law
				441	making observations and asking questions	17	record times

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
				454	describe steps you would take to determine whether pH affects frog population	18	use data to describe relationship between force and motion
				482	atmospheric pressure at various altitudes graph	19	use data to infer correct relationship between variables
				491	what percentage comes from this source? (problem 4)	21	choose independent and dependent variables for graph
				492	observing an aurora	24	collect weight data
				536	proving hypotheses for sea-floor spreading	25	collect force data
				549	determining distance to an epicenter	26	what variables can be changed?
				553	what explains the difference in density? (#5)	27	write down the number of weights you use
				586	form a hypothesis (#7)	27	recognize variables
				611	how big is Earth?	30	interpret block and tackle data
				636	use the data to answer the questions	34	investigate motion on a rollercoaster
				636	what evidence was used to predict the existence of the Kuiper Belt?	36	collect precise speed and height data
				651	apparent brightness vs. distance graph	75	collect mass and amplitude data
				657	use the diagram to answer the questions (#4)	75	perform self-designed experiment
				657	arrange the items in the table (#3)	75	plan three experiments to determine which variable affects the period of a pendulum

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
				657	use the diagram to answer the questions (#2)	75	design pendulum experiment
				658	analysis with a spectrometer (#4)	76	calculate % error
						93	decision trees and the advantage of doing multiple trials
						100	observe glow-in-the-dark paper
						141	build models of Na and Cl and use them to explain bonding
						146	observe evidence of chemical change
						146	record detailed observations
						150	record data as you perform experiment
						151	design experiment to find out if mass is conserved
						158	observe temperature changes in chemical reactions
						169	observe Tyndall effect
						170	which factor will produce fastest dissolving rate?
						170	what three factors influence dissolving rate?
						170	devise hypothesis and explain

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					171 collect time data and record observations
					172 observe dissolving process
					179 safety tip for testing local surface water
					179 make observations about local surface water
					182 making hypotheses and testing them against observations
					182 simulating the effect of acid rain on daphnia
					182 making detailed observations
					182 formulate hypothesis
					182 observing daphnia and recording movements and behavior
					184 collecting pH readings while adding carbon dioxide
					185 analyzing the results of the buffered acid experiment
					186 sensing temperature with fingers
					186 collecting temperature data

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					188 conducting investigation of efficiency of immersion heater
					189 collecting time and temperature data
					190 effect of changing mass on collected data
					192 observe convection currents
					192 observing forced convection through liquids
					193 conducting experiments on heat transfer
					193 explaining efficiency of heat transfer based on data
					193 collecting and recording time and temperature data
					197 calculating error between your barometer and a commercial barometer
					199 importance of good record keeping in order to avoid error
					199 collecting Schönbein strips for detecting ozone
					202 collecting data of temperature and sensations
					202 using your hand to sense temperature differences

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					205 investigating how specific heat of water regulates Earth's temperature
					206 collecting temperature and time data
					208 formulate a hypothesis about why the seasons occur
					210 collecting qualitative data of light intensity at scale distance from the sun
					211 determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
					217 collecting wet and dry bulb temperature readings
					217 determining relationship between temperature of the atmosphere and relative humidity
					218 interpreting Doppler radar images
					224 reconstruct a series of events from clues
					233 identifying how the earthquake model represents an earthquake

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					235 interpreting how the drumming affects the intensity of the earthquake in the model
					237 finding a pattern of volcanoes on a bathymetric map
					237 develop a research plan for studying volcanoes
					243 recording observations of crystal growing
					249 using your sundial to collect accurate data
					251 recording the changes in the moon over a month
					253 calibrating your telescope

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
INQ1.2 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	Select and use appropriate tools including technology to make measurements (in metric units), gather, process and analyze data from investigations using appropriate mathematical analysis, error analysis, and graphical representation.	5	measuring distance	data tables and graphs can be created on computer or graphing calculator	
				6	scientists use metric units		
				11	controlling variables in experiments	5	measuring metric and english lengths
				19	did you run a controlled experiment?	6	compare results with other groups
				20	what factors could explain the variability in their data?	6	measure time
				24	making a graph	7	what variables should be controlled?
				26	creating graphs	9	design three experiments and choose equipment
				41	make a graph	9	design three experiments and choose technology
				42	analyze a speed/distance graph	9	conduct three experiments with appropriate equipment
				294	find the thickness of a single card	9	design three experiments and choose equipment
				441	making observations and asking questions	10	selecting ramp and photogates
				491	what percentage comes from this source? (problem 4)	11	calculate % error
				492	observing an aurora	11	graph speed vs. position
				549	determining distance to an epicenter	11	analyze speed change of car
				553	what explains the difference in density? (#5)	12	make metric length measurement
				611	how big is Earth?		

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				636	what evidence was used to predict the existence of the Kuiper Belt?	12	select equipment and set up experiment
				636	use the data to answer the questions	13	graph distance vs. time
				658	analysis with a spectrometer (#4)	14	record three different time intervals
						15	construct a quantitative graphical model
						16	measure force
						18	study data table for relationship between force and motion
						21	think about percent change
						25	analyze block and tackle data
						25	collect force data
						27	analyze lever equilibrium data
						27	write down the number of weights you use
						30	rigging block and tackle
						35	does data support hypothesis?
						37	organize data into a graph of speed vs. height
						40	choose circuit parts to light a bulb
						44	measure voltage

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					45 did battery voltage change?
					46 measure current
					48 measure resistance
					51 graph voltage vs. current
					76 analyze pendulum data
					76 calculate % error
					87 measure wavelength
					116 measure mass
					117 measure volume
					121 graph mass vs. volume
					129 control the height of the liquid
					145 plan a procedure and select necessary equipment
					145 carry out procedure and select equipment
					146 record detailed observations
					147 organize observations into a category table
					147 students analyze chemical change lab results
					150 record data as you perform experiment
					151 plan procedures and select materials

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					151 select materials from list
					169 why was plain water tested?
					169 what does the word control mean?
					182 observing daphnia and recording movements and behavior
					185 constructing a graph of drops of acid vs pH
					186 measure temperature
					187 construct a graphical model
					189 construct a temperature vs. time graph
					194 design and construct an aneroid barometer
					197 constructing a graph from atmospheric pressure data
					197 calculating error between your barometer and a commercial barometer
					199 collecting Schönbein strips for detecting ozone
					199 importance of good record keeping in order to avoid error
					202 collecting data of temperature and sensations

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					203 graphing water and ice temperature readings
					206 collecting temperature and time data
					206 constructing a graph of time vs. temperature
					209 measuring the intensity of light using an electric meter and solar cell and light bulb
					210 collecting qualitative data of light intensity at scale distance from the sun
					217 collecting wet and dry bulb temperature readings
					243 recording observations of crystal growing
					251 recording the changes in the moon over a month
					252 identifying the parts of a refracting telescope and making observations of the moon's surface
					272 creating computer spreadsheets
					273 creating computer spreadsheets
					274 creating computer spreadsheets

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INQ1.3 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	Review evidence, communicate and defend results, and recognize that the results of a scientific investigation are always open to revision by further investigations. (e.g. through graphical representation of charts)	10 process of reviewing hypothesis explained 19 which group did the best experiment? 527 relative dating and modern geology based on Steno's theories 530 Kelvin's calculations of Earth's age 534 theory of plate tectonics 535 critiquing Wegener's theories of continental drift 569 Darwin's theories of the Andes formation 572 what causes ice ages 617 theories of origin of the moon 618 early theories of the solar system 653 Big Bang theory	18 evaluate graphs as to whether or not they show relationships between variables 21 evaluate percent change for data collected 35 what evidence is there in support of your hypothesis? 39 critique group's explanation of energy transformations 39 analyze energy transformations in different scenarios 39 review energy theory in context of everyday scenarios 75 evaluate statistical significance 77 compare law of conservation of energy to motion of pendulum 77 show how energy loss data could be applied to designing a real clock 101 how could you extend the investigation to explore materials that give off light when heated?

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					117 how could you find the volume of one drop of water? 151 do the data support the hypothesis 151 review your hypothesis 171 evaluate method based on data 171 did you prove or disprove your hypothesis? 171 what was happening at molecular level? 183 specifying how the daphnia experiment could be improved 200 evaluating your qualitative ozone strips

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INQ1.4 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	Analyze observations and explain with scientific understanding to develop a plausible model (e.g. atom, expanding universe)	20	finding variability in data	6	predict which car will move fastest
				24	making a graph	7	test the effect of one other variable
				24	interpretations of patterns in data	9	devise a hypothesis
				26	creating graphs	13	graph distance vs. time
				27	reading a graph	15	construct a quantitative graphical model
				41	make a graph	15	interpret a speed vs. time graph
				80	analyze lever diagram	18	use data to describe relationship between force and motion
				81	look at force data and decide the usefulness of a machine	19	use data to infer correct relationship between variables
				324	proton/electron attraction	21	construct reasonable explanation based on data
				394	showing valence electrons in a diagram	27	think about the variables
				482	atmospheric pressure at various altitudes graph	30	interpret block and tackle data
				651	apparent brightness vs. distance graph	34	where does the marble move the fastest?
				654	evidence for the Big Bang theory	35	study data and determine importance of height on speed of marble
				655	evidence for the Big Bang theory	37	organize data into a graph of speed vs. height
				657	use the diagram to answer the questions (#4)		
657	arrange the items in the table (#3)						
657	use the diagram to answer the questions (#2)						

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					43 how did A and B tapes acquire different charge?
					45 analyze data and explain a rule
					51 graph voltage vs. current
					75 investigate variables that affect the period of a pendulum
					121 graph mass vs. volume
					132 building atom models
					136 model stable and neutral atoms
					140 find the number of electrons in outermost level
					141 build models of Na and Cl and use them to explain bonding
					147 organize observations into a category table
					151 perform the experiment you designed
					151 explain how hypothesis compares to results
					170 devise hypothesis and explain
					182 making hypotheses and testing them against observations

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					185 analyzing the results of the buffered acid experiment
					185 constructing a graph of drops of acid vs pH
					187 construct a graphical model
					189 construct a temperature vs. time graph
					193 explaining efficiency of heat transfer based on data
					197 constructing a graph from atmospheric pressure data
					203 graphing water and ice temperature readings
					206 constructing a graph of time vs. temperature
					208 testing hypothesis of why seasons occur against your observations in the investigation
					217 determining relationship between temperature of the atmosphere and relative humidity
					218 interpreting Doppler radar images
					224 reconstruct a series of events from clues

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					235 interpreting how the drumming affects the intensity of the earthquake in the model 237 finding a pattern of volcanoes on a bathymetric map

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
INQ1.5 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	Identify strengths, weaknesses, and assess the validity of the experimental design of an investigation through analysis and evaluation	11	control and experimental variables	6	predict which car will move fastest
				19	which group did the best experiment?	6	compare results with other groups
				26	independent and dependent variables	7	test the effect of one other variable
				42	analyze a speed/distance graph	7	doing a controlled experiment
				491	what percentage comes from this source? (problem 4)	9	devise a hypothesis
				549	determining distance to an epicenter	11	calculate % error
				553	average density (#5)	11	analyze speed change of car
				553	what explains the difference in density? (#5)	11	graph speed vs. position
				611	how big is Earth?	18	study data table for relationship between force and motion
				624	how big is Earth?	18	evaluate graphs as to whether or not they show relationships between variables
					average distance from the sun	21	choose independent and dependent variables for graph
						21	evaluate percent change for data collected
						21	construct reasonable explanation based on data
		25	analyze block and tackle data				

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					27 think about the variables
					27 recognize variables
					27 analyze lever equilibrium data
					34 where does the marble move the fastest?
					35 does data support hypothesis?
					35 study data and determine importance of height on speed of marble
					43 how did A and B tapes acquire different charge?
					45 analyze data and explain a rule
					45 did battery voltage change?
					75 evaluate statistical significance
					75 investigate variables that affect the period of a pendulum
					76 calculate % error
					76 analyze pendulum data
					101 how could you extend the investigation to explore materials that give off light when heated?

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					117 how could you find the volume of one drop of water?
					129 find average velocity
					147 students analyze chemical change lab results
					151 perform the experiment you designed
					151 explain how hypothesis compares to results
					157 add new rules to list based on findings
					170 devise hypothesis and explain
					171 average dissolving rate
					171 evaluate method based on data
					183 specifying how the daphnia experiment could be improved
					190 effect of changing mass on collected data
					197 calculating error between your barometer and a commercial barometer
					197 evaluating your aneroid barometer design
					199 importance of good record keeping in order to avoid error

Correlation to Montana Standards for Science

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					200 evaluating your qualitative ozone strips 208 testing hypothesis of why seasons occur against your observations in the investigation 211 determining whether distance from light source or axial tilt plays a more significant role in causing the seasons

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
INQ1.6 9-12	Inquiry	Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.	explain how observations of nature form an essential base of knowledge among the Montana American Indians	34	Newton's research impacted mathematics	100	observe glow-in-the-dark paper
				75	impact of technology	146	observe evidence of chemical change
				326	the quests of alchemists	158	observe temperature changes in chemical reactions
				378	observe chemical changes	169	observe Tyndall effect
				397	scientific discovery and the atomic age	172	observe dissolving process
				548	studying seismic waves leads to information used in oil and gas exploration	178	visit local water supply and perform testing
				551	predicting tsunamis	179	make observations about local surface water
				589	history of calendars	186	sensing temperature with fingers
				591	counting the days in a year	192	observe convection currents
				592	the history of clocks and the division of time	192	observing forced convection through liquids
				595	ancient beliefs about solar eclipses	198	making qualitative observations of the amount of ozone present in the school environment
				600	history of the telescope	198	contributions of Schönbein
						202	using your hand to sense temperature differences

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.1a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the structure of atoms, including knowledge of subatomic particles and their relative masses, charges, and locations within the atom	317	location/size/charge of subatomic particles	132	building atom models
				317	protons/neutrons/electrons	133	location of electrons in atom
				324	proton/electron attraction	133	protons and neutrons
				394	showing valence electrons in a diagram	136	model stable and neutral atoms
						137	build atomic models
						140	find the number of electrons in outermost level
						140	review subatomic particles
PS2.1b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the structure of atoms, including knowledge of the electrical and nuclear forces that hold the atom together.	395	electromagnetic force	136	strong force
				395	strong nuclear force		
				395	forces in the nucleus		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.1c 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the structure of atoms, including the knowledge of fission and fusion.	393	fusion and fission explained	138	nuclear reactions
				394	nuclear vs chemical reactions	138	fusion and fission
				399	carbon dating	160	how do you simulate nuclear decay?
				399	radioisotopes in science and medicine	160	radioactive decay
				406	research pros and cons of nuclear technology	161	research pros and cons of uses for radioactive elements
				629	nuclear fusion and the sun		
PS2.1d 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the structure of atoms, including the knowledge of radioactive decay.	322	isotopes explained	133	exploring isotopes
				349	mole quantities	136	understanding isotopes
				363	combustion reaction	144	show ratios in which elements combine to form a compound
				367	heartburn reaction		
				397	half-life	148	chemical equations
				405	find the half-life of a radioactive isotope	160	radioactive decay
				425	dissociation of water		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.2a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of valance electrons on the chemical properties of the elements and the resulting periodic trends in these properties.	317	all matter is formed from atoms	132	atomic number determines what element that atom is
				317	all matter is formed from atoms	132	comparing atoms
				321	atoms of same element have same atomic number	133	using the periodic table
				326	groups of elements	137	importance of atomic number
				327	groups of elements and valence shells	141	build model of Na and Cl atoms and explain why they bond to form a molecule
				335	periodic table columns and valence electrons	142	arrangement of electrons and groups of elements
				336	bonding and periodic table position		
				338	periodic table and electronegativities		
				338	metals nonmetals and metalloids		
				341	periodic table and oxidation numbers		

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.2b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of chemical bonding	327	groups of elements and valence shells	136	ions
				330	use the periodic table to predict chemical formulas	141	build model of Na and Cl atoms and explain why they bond to form a molecule
				330	which element is more likely to combine with other elements?	141	modeling a chemical bond
				335	periodic table columns and valence electrons	141	when an atom ionizes
				336	ionic bonds	142	arrangement of electrons and groups of elements
				336	Lewis dot diagrams	143	classify ionic compounds
				336	bonding and periodic table position		
				337	covalent bonds		
				338	distinguishing between ionic and covalent bonds		
				338	periodic table and electronegativities		
				341	chemical bonding and the periodic table		
				341	periodic table and oxidation numbers		
				410	water is a polar molecule		
				411	hydrogen bonding in water		
				412	hydrogen bonding and properties of water		
				415	dissolving an ionic compound		

**Correlation to Montana Standards for Science
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 Student Text and Investigation Manual**

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page	
PS2.2c 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of molecular geometry.	416	solute dissolution depends on chemical bonds	144 show ratios in which elements combine to form a compound 162 carbon reactions and the environment
				337	ionic bonds in a salt crystal	
				337	ionic bonds	
				338	formation of an ionic bond	
				340	ionic compounds	
				349	mole quantities	
				370	carbon chains	
				409	a water molecule is v-shaped	
				409	water structure and its function as a solvent	
				415	why water is called the universal solvent	

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.2d 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of kinetic molecular theory on phases of matter.	290	states of matter and arrangement of molecules	118	molecules in a liquid
				290	changes of state	118	investigate melting
				411	molecular structure of ice	118	think of melting process at molecular level
				457	increasing temperature means increasing motion of molecules	119	adding heat energy to melt an ice cube
				457	temperature is a measure of average kinetic energy	119	energy and phase changes
				458	molecular motion increases when temperature increases		
				504	phases changes in the atmosphere		
PS2.2e 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how the particulate level structure and properties of matter affect its macroscopic properties, including the effect of carbon-carbon atom bonding on biomolecules	370	carbon chains	162	carbon reactions and the environment
				400	photosynthesis and carbon reactions	162	structure of fossil fuels
				401	fossil fuels and carbon reactions	162	importance of fossil fuels

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.3a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the major features associated with chemical reactions, including giving electricity and sound the characteristics of light, heat, motion, magnetism, electricity, sound and mechanical waves and examples important to industry and living organisms	363	combustion reaction	148	chemical equations
				367	chemical reactions in living systems	158	investigate energy changes in chemical reactions
				367	heartburn reaction		
				384	combustion reactions	158	measure energy changes in 3 different reactions
				384	consumer chemistry	162	investigating combustion reactions
				387	MRE ration heater reaction		
				387	exothermic reactions and MREs		
				388	endothermic reactions and cold packs		
				401	chemistry of the atmosphere		
				401	chemistry of the atmosphere		
				403	carbon reactions		
				425	dissociation of water		
				444	chemical reactions and the formation of acid rain		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.3b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the major features associated with chemical reactions, including energy changes associated with chemical changes	89	energy conservation and earth systems	37	investigating conservation of energy with rollercoaster
				89	efficiency and energy transfer in natural systems	38	explore energy transformations
				90	energy conservation and efficiency in biological systems	38	conservation of energy and energy transformations
				92	potential and kinetic energy explained	39	identify type of energy involved
				94	conservation of energy explained	147	feel the heat generated by chemical reaction
				95	understand basic forms of energy	158	investigate energy changes in chemical reactions
				95	energy conversions		
				96	energy transformations and conservation	158	measure energy changes in 3 different reactions
				97	different forms of energy described		
				100	energy conservation and swimming		
				102	prove that energy is conserved		
				387	exothermic reactions and MREs		
				388	endothermic reactions and cold packs		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.3c 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the major features associated with chemical reactions, including classes of chemical reactions.	360	chemical reactions and digestion	148	reactants and products
				365	balancing chemical equations	149	balance these equations
				370	formation of petroleum is a very slow chemical reaction	149	practice balancing equations
				377	which of the equations is balanced?	152	write the balanced equation
				381	synthesis or addition reactions	152	predict how much product formed given the reactants
				382	decomposition reactions	156	investigate double displacement reactions
				383	double displacement reactions	156	predict products in a double displacement reaction
				383	single displacement reactions	157	predict the products of double displacement reactions
				428	acids and bases and enzymes in digestion		
PS2.3d 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe the major features associated with chemical reactions, including rates of reactions	370	formation of petroleum is a very slow chemical reaction	156	predict products in a double displacement reaction
						157	predict the products of double displacement reactions

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.4 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Identify, measure, calculate, and analyze relationships associated with matter and energy transfer or transformations, and the associated conservation of mass	89	energy conservation and earth systems	36	energy conservation and the roller coaster
				89	efficiency and energy transfer in natural systems	37	investigating conservation of energy with rollercoaster
				90	energy conservation and efficiency in biological systems	38	conservation of energy and energy transformations
				92	potential and kinetic energy explained	38	explore energy transformations
				94	conservation of energy explained	150	investigate conservation of mass in effervescent tablet reaction
				95	energy conversions		
				96	energy transformations and conservation		
				97	different forms of energy described		
				100	energy conservation and swimming		
				102	prove that energy is conserved		
369	history of law of conservation of mass						

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.5a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain the interactions between motions and forces, including the laws of motion.	45	Newton's third law summarized	14	exploring acceleration on a ramp
				45	Newton's second law summarized	16	unbalanced forces and acceleration of car
				45	Newton's first law summarized	16	thinking about force
				46	force has potential to change motion	19	discover 2nd law of motion
				48	Newton's first law in detail	19	find correct relationship between force mass and acceleration
				49	force is related to acceleration	21	effect of friction on the car
				49	Newton's second law in detail	22	car and ramp and Newton's 3rd law
				51	net force explained	23	using 3rd law to explain common phenomena
				51	balanced and unbalanced forces		
				56	friction explained		
				59	Newton's third law in detail		
				64	research effect of friction on human joints		
				64	solving problems using $f=ma$		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.5b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain the interactions between motions and forces including an understanding of the gravitational and electromagnetic forces	48	Newton's laws explained and applied	16	2nd law
				50	Newton's second law applied	20	force and motion with car and ramp
				52	gravity depends on mass	20	investigate effect of gravity on motion
				52	the effect of gravity	62	describing forces that magnets exert on each other
				54	Newton's law of universal gravitation	64	testing materials to see if they are affected by magnets
				55	calculating gravitational force between objects	66	compare electromagnets and permanent magnets
				112	electrical force is incredibly strong!	158	measure energy changes in 3 different reactions
				112	electrical forces	257	relating the relationship between orbital speed and distance to the equation of universal gravitation
				165	magnetism explained		
				169	understanding magnetic fields		
				537	interesting magnetic patterns on sea floor		
				537	magnetic polarity of Earth		
				605	Newton's first law of motion and the space shuttle		
612	Newton's law of universal gravitation						

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.6a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how energy is stored, transferred and transformed including the conservation of energy.	87	some input work is converted to heat	37	investigating conservation of energy with rollercoaster
				89	energy conservation and earth systems	38	explore energy transformations
				89	efficiency and energy transfer in natural systems	38	conservation of energy and energy transformations
				90	energy conservation and efficiency in biological systems	39	make an energy flow chart
				91	concept of energy as stored work	39	identify type of energy involved
				92	potential and kinetic energy explained		
				94	conservation of energy explained		
				95	understand basic forms of energy		
				95	energy conversions		
				95	following an energy transformation		
				96	where does "spent" energy go?		
				96	energy transformations and conservation		
				97	different forms of energy described		
				100	energy conservation and swimming		
				102	explain the "lost" energy		

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.6b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how energy is stored, transferred and transformed including kinetic and potential energy and energy contained by a field.	102	prove that energy is conserved		
				629	energy from the sun		
				632	harnessing the sun's energy		
				165	magnetism explained	36	energy conservation and the roller coaster
				169	understanding magnetic fields	62	describing forces that magnets exert on each other
				170	what is an electromagnet?		
				172	increased current vs. strength of magnetic field	64	testing materials to see if they are affected by magnets
				172	building an electromagnet		
				457	increasing temperature means increasing motion of molecules	66	compare electromagnets and permanent magnets
						66	build an electromagnet
				457	temperature is a measure of average kinetic energy	67	find out what happens to strength of electromagnet when current is increased
				458	molecular motion increases when temperature increases	119	adding heat energy to melt an ice cube
				460	changes in temperature are directly related to changes in energy	119	investigate temperature and energy transfer in melting process
				537	interesting magnetic patterns on sea floor		
537	magnetic polarity of Earth	188	investigate the increase of temperature of water as thermal energy is added				

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
PS2.6c 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how energy is stored, transferred and transformed including heat energy and molecular motion.	457	temperature is a measure of average kinetic energy	119	investigate temperature and energy transfer in melting process
				460	changes in temperature are directly related to changes in energy	188	investigate the increase of temperature of water as thermal energy is added
				467	thermal conductivity explained	192	investigate convection in liquids
				468	heat transfer through air	192	observing and measuring the transfer of heat through liquids by forced and natural convection
				468	densely packed solids are good conductors of heat	192	investigate heat transfer through a liquid by natural convection
				469	convection currents and weather	193	investigate heat transfer through a liquid by forced convection
				469	warming hands over candle		
				470	convection currents in water		
				471	solid road surface emits radiation		
				471	transfer of heat by radiation		
				488	global warming and heat transfer by radiation		
				499	apply knowledge of heat transfer to different situations		
				531	convection inside Earth		

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.6d 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Explain how energy is stored, transferred and transformed including how energy tends to change from concentrated to diffuse.	86	work input and output	31	work output vs. work input
				87	some input work is converted to heat		
				96	where does "spent" energy go?		
				102	explain the "lost" energy		
				466	thermal equilibrium		
PS2.7a 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe how matter and energy interact including waves.	225	frequency of sound and pitch	83	find speed of a wave
				226	voice recognition programs	86	adjust frequency of a standing wave
				226	white noise	90	investigate human perception of sound
				226	sonograms	90	what is sound and how do we hear it?
				227	importance of wavelength of sound waves	98	investigate sound and music
				232	musical instruments		
				486	electromagnetic radiation		
				544	body waves		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.7b 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe how matter and energy interact including the electromagnetic spectrum.	202	waves are all around us	83	find speed of a wave
				227	importance of wavelength of sound waves	86	adjust frequency of a standing wave
				243	light waves and the electromagnetic spectrum		
				243	microwave ovens		
				243	radio and television signals		
				256	identify uses of electromagnetic waves		
				278	identify uses of electromagnetic waves		
PS2.7c 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe how matter and energy interact including the quantization of energy.	68	compound machines	29	design and construct complex gear machines
				102	decide whether or not work is done	31	work = force X distance

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
PS2.7d 9-12	Physical Science	Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.	Describe how matter and energy interact including insulators and conductors.	300	development of Kevlar brand fiber	188	investigate heating water with an immersion heater
				461	examples of flow of heat		
				463	engineers use specific heat of substances to design better products		
				467	conduction and convection and radiation		
				467	thermal conductivity explained		
				629	nuclear fusion on the sun produces energy from matter		
				639	Einstein's equation		

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Standard #: Grade	Topic	Content Standard	Benchmark		Volume 1 Student Text Page	Volume 2 Investigation Manual Page	
SH6.1 9-12	Science and History	Students understand historical developments in science and technology.	Analyze and illustrate the historical impact of scientific and technological advances, including Montana American Indian examples	34	Newton's research impacted mathematics	198	contributions of Schönbein
				75	impact of technology	264	understand why spectroscopy is an important tool of astronomers
				122	batteries, energy, and voltage	268	measuring apparent brightness to calculate the distance to stars and galaxies
				125	circuit breakers		
				126	ground fault circuit interrupter		
				131	how a light bulb works		
				171	how does an electric doorbell work?		
				247	how an LCD display works		
				252	how color printers work		
				254	how a color TV works		
				273	fiber optics		
				318	Dalton's contributions		
				326	the quests of alchemists		
				327	Mendeleev's periodic table		
				338	Linus Pauling and electronegativities		
				369	Antoine Lavoisier		
				397	scientific discovery and the atomic age		
				399	accomplishments of Marie Curie		
				399	Marie and Pierre Curie		
				406	clean air act of 1970		

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				435 governments managing water resources	
				439 the clean water act	
				445 catalytic converters and scrubbing reduce acid rain	
				454 what is the history of your community's water supply and treatment	
				454 is acid rain a problem in your community?	
				454 how is the government addressing the problem of acid rain?	
				463 Joseph Black	
				485 London Agreement of 1991	
				489 should governments enforce changes for lowering greenhouse gas levels	
				489 hydrogen powered cars	
				544 what we can learn from seismographs	
				548 studying seismic waves leads to information used in oil and gas exploration	
				550 understanding earthquakes allows engineers to design safer buildings	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				551 predicting tsunamis	
				589 history of calendars	
				591 counting the days in a year	
				592 the history of clocks and the division of time	
				595 ancient beliefs about solar eclipses	
				600 history of the telescope	
				600 history of the telescope	
				601 types and uses of telescopes	
				602 photo from the Very Large Array	
				602 types and uses of telescopes	
				603 satellites as tools of astronomy	
				604 spacecraft as tools of astronomy	
				640 the use of spectroscopy to analyze stars	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
SH6.2 9-12	Science and History	Students understand historical developments in science and technology.	Trace developments that demonstrate scientific knowledge is subject to change as new evidence becomes available	34	Aristotle vs. Newton	6	asking questions and learning about natural world
				34	Newton and the history of physics	130	investigate Rutherford's gold foil experiment
				45	Newton's Laws of Motion	151	do the data support the hypothesis
				45	Newton's discovery of the 2nd law	157	add new rules to list based on findings
				46	oldest known standard weight	171	what was happening at molecular level?
				54	Newton and the force of gravity	197	evaluating your aneroid barometer design
				111	Benjamin Franklin	215	the food paradox of the oceans
				113	Charles-Augustin Coulomb		
				140	history of superconductivity		
				167	history of magnetism		
				318	history of atomic theory		
				318	contributions of Fermi		
				319	development of atomic theory		
				327	contributions of Mendeleev		
				330	research and create a poster to illustrate development of atomic model		
				338	plate tectonic history		
				349	Avogadro's number		
369	history of law of conservation of mass						

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Student Text and Investigation Manual

Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				399	
				contributions of Marie and Pierre Curie	
				399	
				history of nuclear chemistry	
				406	
				research the Clean Air Act of 1970 and 1990	
				454	
				research local water supply history	
				474	
				research the history of heat and temperature	
				479	
				why do ears pop	
				510	
				meteorologists use atmospheric pressure data to understand movement of weather systems	
				534	
				development of plate tectonic theory	
				535	
				continental drift theory	
				535	
				continental drift theory history	
				618	
				changing ideas about the solar system	
				654	
				development of Big Bang theory	
				654	
				evidence for Big Bang theory	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
SH6.3 9-12	Science and History	Students understand historical developments in science and technology.	Describe, explain, and analyze science as a human endeavor and an ongoing process	11	controlling variables in experiments	6	asking questions and learning about natural world
				19	did you run a controlled experiment?	7	what variables should be controlled?
				20	what factors could explain the variability in their data?	11	calculate % error
				23	why make models?	39	study energy transformations in daily life scenarios
				24	what is a scientific model?	76	calculate % error
				24	scientific models	129	control the height of the liquid
				58	Newton on a skateboard	157	add new rules to list based on findings
				80	describe a problem that would be solved by an engineer	163	evaluating choice of favorite car
				122	batteries, energy, and voltage	169	what does the word control mean?
				125	circuit breakers	169	why was plain water tested?
				126	circuits in your house	179	researching and preparing for a field trip to test surface water
				126	ground fault circuit interrupter	197	calculating error between your barometer and a commercial barometer
				131	how a light bulb works	197	evaluating your aneroid barometer design
				171	how does an electric doorbell work?		
				220	ultrasound technology		
				226	voice recognition technology		
				247	how an LCD display works		
252	how color printers work						

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				254	199
				273	199
				300	201
				406	201
				435	202
				439	202
				445	204
				454	212
				454	215
				454	218
				458	232
				460	258
				467	277
				471	
				479	

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				479	
				why do ears pop	
				482	
				atmospheric pressure in Denver	
				485	
				London Agreement of 1991	
				489	
				should governments enforce changes for lowering greenhouse gas levels	
				489	
				hydrogen powered cars	
				491	
				computer modeling to predict greenhouse effects	
				491	
				what percentage comes from this source? (problem 4)	
				496	
				using the North Star to estimate your latitude	
				500	
				modeling air currents	
				510	
				meteorologists use atmospheric pressure data to understand movement of weather systems	
				515	
				how do animals survive in the desert	
				524	
				create a model (#1)	
				530	
				model of Earth's history	
				539	
				modeling plate boundaries	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				542	
					analogy of plate movements
				544	
					what we can learn from seismographs
				549	
					determining distance to an epicenter
				550	
					understanding earthquakes allows engineers to design safer buildings
				553	
					what explains the difference in density? (#5)
				582	
					rock cycle model
				611	
					how big is Earth?
				620	
					solar system modeling
				630	
					model of the sun's anatomy
				654	
					evidence for Big Bang theory

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STC5.1 9-12	Science Technology and Culture	Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.	Predict how key factors (e.g., technology, competitiveness, and world events) affect the development and acceptance of scientific thought	34	Aristotle vs. Newton	39	critique group's explanation of energy transformations
				45	Newton's Laws of Motion	70	using engineering design cycle
				54	Newton and the force of gravity	77	show how energy loss data could be applied to designing a real clock
				75	relationship between science and technology	177	research pH indicators
				111	Benjamin Franklin	180	researching where your water comes from
				113	Charles-Augustin Coulomb	198	contributions of Schönbein
				122	batteries, energy, and voltage	201	researching the causes of ozone
				125	circuit breakers	207	researching how bodies of water affect climate
				126	ground fault circuit interrupter	222	researching an animal that is adapted to live in the biome you studied
				131	how a light bulb works	227	researching forensic science
				141	circuit board explained		
				171	how does an electric doorbell work?		
				247	how an LCD display works		
				252	how color printers work		
				254	how a color TV works		
				273	fiber optics		
				326	the quests of alchemists		
				338	plate tectonic history		
				397	scientific discovery and the atomic age		
				422	the science of scuba diving		

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				439	
				the clean water act	
				445	
				catalytic converters and scrubbing	
				reduce acid rain	
				489	
				hydrogen powered cars	
				534	
				development of plate tectonic theory	
				535	
				continental drift theory history	
				535	
				critiquing Wegener's theories of continental drift	
				535	
				continental drift theory	
				536	
				using echo sounders to map the sea floor	
				544	
				what we can learn from seismographs	
				550	
				understanding earthquakes allows engineers to design safer buildings	
				589	
				history of calendars	
				591	
				counting the days in a year	
				592	
				the history of clocks and the division of time	
				595	
				ancient beliefs about solar eclipses	
				600	
				history of the telescope	
				603	
				using satellite technology	
				605	
				space shuttle	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				618 changing ideas about the solar system	
				618 early theories of the solar system	
				633 research space solar power	
				654 development of Big Bang theory	

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STC5.2 9-12	Science Technology and Culture	Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.	Give examples of scientific innovation challenging commonly held perceptions	<p>34 Newton's research impacted mathematics</p> <p>34 Newton and the history of physics</p> <p>45 Newton's discovery of the 2nd law</p> <p>46 oldest known standard weight</p> <p>75 impact of technology</p> <p>140 history of superconductivity</p> <p>167 history of magnetism</p> <p>220 ultrasound technology</p> <p>226 voice recognition technology</p> <p>300 invention of Kevlar</p> <p>318 contributions of Fermi</p> <p>318 history of atomic theory</p> <p>319 development of atomic theory</p> <p>330 research and create a poster to illustrate development of atomic model</p> <p>349 Avogadro's number</p> <p>369 history of law of conservation of mass</p>	130 investigate Rutherford's gold foil experiment

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				399	
				history of nuclear chemistry	
				399	
				contributions of Marie and Pierre Curie	
				406	
				research the Clean Air Act of 1970 and 1990	
				454	
				research local water supply history	
				529	
				faunal succession	
				548	
				studying seismic waves leads to information used in oil and gas exploration	
				551	
				predicting tsunamis	

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
STC5.3 9-12	Science Technology and Culture	Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.	Evaluate the ongoing, collaborative scientific process by gathering and critiquing information	10 process of reviewing hypothesis explained 116 study appliance labels and instructions 148 create pamphlet on utility's energy saver programs 339 problems with disposing of plastics 361 recycling tires 362 recycling discarded tires 370 petroleum 398 storage of nuclear waste 438 water cycle and conservation 439 wise use of water 441 water usage and quality 454 study claims made by bottled water companies 530 Kelvin's calculations of Earth's age 535 critiquing Wegener's theories of continental drift 618 early theories of the solar system	35 what evidence is there in support of your hypothesis? 39 analyze energy transformations in different scenarios 39 critique group's explanation of energy transformations 76 analyze watch manufacturer's claims 77 compare law of conservation of energy to motion of pendulum 77 show how energy loss data could be applied to designing a real clock 151 review your hypothesis 162 inferences from promotional materials for vehicles 163 can trees compensate for manmade CO2 from vehicles and industry? 163 consider a vehicle's fuel economy 164 perform water quality tests 171 did you prove or disprove your hypothesis? 178 wise use of water supply

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					179 maintaining water supply quality 180 save water for houseplants 180 perform water quality tests 181 study water filtration device claims

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Standard #: Grade	Topic	Content Standard	Benchmark	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
STC5.4 9-12	Science Technology and Culture	Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.	Analyze benefits, limitations, costs, consequences, and ethics involved in using scientific and technological innovations (e.g., biotechnology, environmental issues)	374 limiting reactants 385 research fuel cells 385 research fuel cells 385 hydrogen-powered cars and the environment 385 research economic impact of fuel cells 385 research environmental impact of fuel cells 397 nuclear vs. fossil fuels 397 impact of nuclear energy 401 fossil fuels 406 problems caused by airborne pollutants 406 economic impact of pollution 406 reducing pollution 406 economic impact of reducing air pollution 420 environmental impact of electrical generating facilities 442 effect of excess nitrates on environment 444 impact of using fossil fuels 454 research economic impact of producing gases that cause acid rain	52 the cost of using electrical appliances 163 economic impact of end-product of combustion reaction 163 too much CO ₂ 163 research how trees offset accumulation of CO ₂ 163 research how trees offset accumulation of CO ₂ 201 research the causes of ozone in the lower atmosphere 262 solar energy can be used to generate electricity without producing pollution

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STC5.5 9-12	Science Technology and Culture	Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.	Explain how the knowledge of science and technology applies to contemporary Montana American Indian communities (e.g., natural resources development, management and conservation)	633	using photovoltaic cells		
				141	circuit board explained	52	the cost of using electrical appliances
				178	generating electric power	163	consider a vehicle's fuel economy
				339	problems with disposing of plastics	163	can trees compensate for manmade CO2 from vehicles and industry?
				361	recycling tires	164	perform water quality tests
				362	recycling discarded tires	178	wise use of water supply
				370	petroleum	179	maintaining water supply quality
				397	impact of nuclear energy	180	save water for houseplants
				398	storage of nuclear waste	180	perform water quality tests
				406	reducing pollution	262	determine the efficiency of a photovoltaic cell
				420	effect of electrical generating facilities on dissolved oxygen in water		
				438	water cycle and conservation		
				439	wise use of water		
				441	water usage and quality		
				566	description of geothermal energy		
				633	the efficiency of photovoltaic cells		