

Correlation to Kansas Science Education Standards (draft 2d)
Foundations of Physical Science with Earth and Space Science
Student Text and Investigation Manual

Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
1.1.1 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student actively engages in asking and evaluating research questions.	10	the research question and hypothesis	6	how do we ask questions and get answers from nature?
				429	why haven't we run out of water	7	perform your own experiment
				434	what is in your tap water		
				437	what is acid rain	10	conduct car/ramp experiment
				441	why are oceans salty	16	investigate Newton's 2nd law
				451	what is temperature		
				456	asking questions pertaining to specific heat and heat flow	34	investigate motion on a rollercoaster
				472	why is Earth's atmosphere different from other planets	75	perform self-designed experiment
				473	why do ears pop	170	which method will give fastest dissolving rate?
				492	why does Earth have seasons	182	simulating the effect of acid rain on daphnia
				501	how does rain form	188	conducting investigation of efficiency of immersion heater
				509	how do animals survive in the desert	193	conducting experiments on heat transfer
				515	what is a carbon sink		
				534	why doesn't Earth get bigger and bigger	205	investigating how specific heat of water regulates Earth's temperature
				588	what causes eclipses		
				621	is Pluto a planet		

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1.1.2 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student actively engages in investigations, including developing questions, gathering and analyzing data, and designing and conducting research	7	experimentation begins with a question	7	perform your own experiment
				9	steps in the scientific method	7	compare results with hypothesis
				10	forming a hypothesis	7	design your own experiment
				11	control and experimental variables	7	doing a controlled experiment
				12	writing lab procedures	9	design three experiments using car and ramp
				19	design your own experiment	9	conduct three experiments with appropriate equipment
				19	design your own experiment	10	conduct car/ramp experiment
				26	independent and dependent variables	10	selecting ramp and photogates
				42	devise an experiment	12	select equipment and set up experiment
				448	describe steps you would take to determine whether pH affects frog population	16	investigate Newton's 2nd law
						16	decide how to vary the force on the car for this experiment
						21	choose independent and dependent variables for graph
						26	what variables can be changed?
						27	recognize variables

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					30 rigging block and tackle
					34 investigate motion on a rollercoaster
					40 choose circuit parts to light a bulb
					75 design pendulum experiment
					75 plan three experiments to determine which variable affects the period of a pendulum
					75 perform self-designed experiment
					93 decision trees and the advantage of doing multiple trials
					145 carry out procedure and select equipment
					151 select materials from list
					151 design experiment to find out if mass is conserved
					170 write a procedure
					170 which factor will produce fastest dissolving rate?
					170 what three factors influence dissolving rate?
					182 simulating the effect of acid rain on daphnia

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					188 conducting investigation of efficiency of immersion heater
					190 effect of changing mass on collected data
					193 conducting experiments on heat transfer
					196 writing a procedure for constructing a pointer for an aneroid barometer
					205 investigating how specific heat of water regulates Earth's temperature
					209 measuring the intensity of light using an electric meter and solar cell and light bulb
					211 determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
					214 develop a procedure to create an underwater spring
					233 identifying how the earthquake model represents an earthquake
					237 develop a research plan for studying volcanoes

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					252 identifying the parts of a refracting telescope and making observations of the moon's surface

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1.1.3 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student actively engages in using technological tools and mathematics in their own scientific investigations.	24	using an electronic timer	data tables and graphs can be created on computer or graphing calculator
				26	drawing a best fit curve	
				31	determining slope of a line	
				38	determining slope of a line	11 draw best fit curve
				42	interpreting distance/time graph	12 using photogates
				459	heat equation	13 draw best fit curve
				497	sling psychrometer	14 using photogates
				594	telescopes	15 calculating acceleration from the slope of the line
				645	inverse square law	16 use a force scale
						17 use photogates to study car on ramp
						18 use a balance to find mass of car
						25 create a mathematical model
						27 find math rule for lever equilibrium
						28 derive a math formula
						30 use force scale
						44 using electrical meter
						46 using electrical meter
						48 using electrical meter
						50 using electrical meter
						86 use CPO Timer to measure frequency

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					107 study reflection of laser beam
					108 study refraction of laser beam
					113 trace critical angle with a laser beam
					158 use a thermometer
					187 find slope of a trend line
					187 draw a line of best fit through temperature data points
					187 find equation for trend line
					189 calculate slope of a graph
					197 graphing and drawing a trend line for atmospheric pressure data
					257 inverse square law
					268 discovering the mathematical relationship between apparent brightness and distance

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1.1.4 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student actively engages in conducting an inquiry, formulating and revising his or her scientific explanations and models, and recognizing that potential alternative explanations and models should be considered.	11	control and experimental variables	7	what variables should be controlled?
				11	controlling variables in experiments	7	doing a controlled experiment
				19	which group did the best experiment?	9	construct a data table
				19	did you run a controlled experiment?	11	calculate % error
				20	what factors could explain the variability in their data?	12	understand and use data table
				20	finding variability in data	13	graph distance vs. time
				24	interpretations of patterns in data	14	record three different time intervals
				24	making a graph	15	interpret a speed vs. time graph
				26	creating graphs	15	construct a quantitative graphical model
				26	independent and dependent variables	17	record results in data table
				27	reading a graph	18	evaluate graphs as to whether or not they show relationships between variables
				41	make a graph	18	organize different combinations of data
				42	interpreting distance/time graph	18	use data to describe relationship between force and motion
				78	analyze lever diagram	19	use data to infer correct relationship between variables
				79	look at force data and decide the usefulness of a machine		
				435	making observations and asking questions		

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				459	heat equation	21	construct reasonable explanation based on data
				476	atmospheric pressure at various altitudes graph	21	evaluate percent change for data collected
				485	what percentage comes from this source? (problem 4)	21	choose independent and dependent variables for graph
				486	observing an aurora		
				543	determining distance to an epicenter	24	use data table to record results
				547	what explains the difference in density? (#5)	25	create a mathematical model
				547	average density (#5)	25	collect force data
				605	how big is Earth?	27	use data table to record results
				618	average distance from the sun	27	write down the number of weights you use
				630	use the data to answer the questions	27	find math rule for lever equilibrium
				630	what evidence was used to predict the existence of the Kuiper Belt?	27	recognize variables
				645	apparent brightness vs. distance graph	28	derive a math formula
				645	inverse square law	30	interpret block and tackle data
				651	use the diagram to answer the questions (#4)	30	record ropes and pulley data in table
				651	use the diagram to answer the questions (#2)	35	study data and determine importance of height on speed of marble
				651	arrange the items in the table (#3)	36	organize data into a table

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				652 analysis with a spectrometer (#4)	37 organize data into a graph of speed vs. height 45 analyze data and explain a rule 51 graph voltage vs. current 75 create data table for self-designed experiment 75 evaluate statistical significance 76 calculate % error 121 graph mass vs. volume 129 control the height of the liquid 129 find average velocity 141 build models of Na and Cl and use them to explain bonding 146 record detailed observations 147 organize observations into a category table 150 record data as you perform experiment 151 does your experiment agree with law of conservation of mass? 151 design a data table 157 add new rules to list based on findings

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					169 why was plain water tested?
					169 what does the word control mean?
					171 evaluate method based on data
					171 use data table for observations
					171 average dissolving rate
					181 organize water quality data into a table
					182 observing daphnia and recording movements and behavior
					182 making hypotheses and testing them against observations
					185 constructing a graph of drops of acid vs pH
					185 analyzing the results of the buffered acid experiment
					187 construct a graphical model
					187 find equation for trend line
					189 construct a temperature vs. time graph
					190 effect of changing mass on collected data

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					193 explaining efficiency of heat transfer based on data
					197 calculating error between your barometer and a commercial barometer
					197 evaluating your aneroid barometer design
					197 constructing a graph from atmospheric pressure data
					199 importance of good record keeping in order to avoid error
					199 collecting Schönbein strips for detecting ozone
					200 evaluating your qualitative ozone strips
					202 collecting data of temperature and sensations
					203 graphing water and ice temperature readings
					206 constructing a graph of time vs. temperature
					206 collecting temperature and time data
					210 collecting qualitative data of light intensity at scale distance from the sun

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					211 determining whether distance from light source or axial tilt plays a more significant role in causing the seasons
					217 determining relationship between temperature of the atmosphere and relative humidity
					217 collecting wet and dry bulb temperature readings
					218 interpreting Doppler radar images
					224 reconstruct a series of events from clues
					231 evaluating your completed bathymetric map
					235 interpreting how the drumming affects the intensity of the earthquake in the model
					237 finding a pattern of volcanoes on a bathymetric map
					243 recording observations of crystal growing
					247 evaluate your ability to interpret rock formations
					251 recording the changes in the moon over a month

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					257 inverse square law
					268 discovering the mathematical relationship between apparent brightness and distance

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1.1.5 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student actively engages in communicating and defending the design, results, and conclusion of his/her investigation.	20	explain your reasoning	9	present conclusions to the class
				27	how to read a graph	9	reporting on an experiment
						15	discuss and test ideas with your group
						19	explain how you arrived at your answer
						29	discuss what you learned about gears
						37	describe the flow of energy based on experimental graph
						39	give a brief presentation to the class
						47	discuss an explanation with your group
						47	present and defend an explanation
						78	reading harmonic motion data tables and graphs
						129	explain your answer and justify
						145	present findings and methods used
						145	present findings to the class
						151	present results to the class

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					179 create water quality report 181 write paragraph to explain results 183 write summary of findings

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1.1.6 SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.	8 - 12	The student will demonstrate the abilities necessary to do scientific inquiry.	The student understands methods used to test hypotheses.	11	controlling variables in experiments	4	difference between precise and accurate data
				12	importance of reliable and accurate data collection	6	electronic timer and release technique
				19	did you run a controlled experiment?	7	record time interval
				20	how will speed change?	7	what variables should be controlled?
				20	what factors could explain the variability in their data?	9	collect speed data
				24	predicting speed from a graph	13	graph distance vs. time
				24	making a graph	15	construct a quantitative graphical model
				26	creating graphs	17	record times
				41	make a graph	21	construct reasonable explanation based on data
				42	predict the speed of a car	21	think about percent change
				42	interpreting distance/time graph	24	collect weight data
				459	heat equation	25	create a mathematical model
				645	inverse square law	27	find math rule for lever equilibrium
						28	derive a math formula
						35	study data and determine importance of height on speed of marble
						36	collect precise speed and height data

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					37 organize data into a graph of speed vs. height
					45 analyze data and explain a rule
					51 graph voltage vs. current
					75 collect mass and amplitude data
					76 use data to predict best string length for a pendulum clock
					121 graph mass vs. volume
					121 use graph to predict mass of six objects
					129 control the height of the liquid
					147 organize observations into a category table
					151 do the data support the hypothesis
					151 does your experiment agree with law of conservation of mass?
					156 make predictions about solubility
					169 why was plain water tested?
					169 what does the word control mean?

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					171 what was happening at molecular level?
					171 collect time data and record observations
					182 making detailed observations
					184 collecting pH readings while adding carbon dioxide
					185 constructing a graph of drops of acid vs pH
					186 collecting temperature data
					187 construct a graphical model
					187 find equation for trend line
					189 collecting time and temperature data
					189 construct a temperature vs. time graph
					193 collecting and recording time and temperature data
					197 constructing a graph from atmospheric pressure data
					201 predicting areas with high ozone concentration based on your data

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					203 graphing water and ice temperature readings
					204 predicting what would happen if you place your ice/water test tube into a hot cup or a cold cup
					206 constructing a graph of time vs. temperature
					231 evaluating your completed bathymetric map
					239 estimating the number of meteor collisions on Earth during the last 3.5 billion years
					242 predicting the results of the crystal-growing experiment
					247 evaluate your ability to interpret rock formations
					249 using your sundial to collect accurate data
					253 calibrating your telescope
					257 inverse square law
					268 discovering the mathematical relationship between apparent brightness and distance

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2A.1.1 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the structure of the atom.	The student understands atoms, the fundamental organizational unit of matter, are composed of subatomic particles, organized in a small, dense, positively charged nucleus and surrounded by a negatively charged electron cloud.	311	protons/neutrons/electrons	132	atomic number determines what element that atom is
				311	location/size/charge of subatomic particles	132	building atom models
				315	atoms of same element have same atomic number	133	protons and neutrons
				318	proton/electron attraction	133	location of electrons in atom
				388	showing valence electrons in a diagram	136	model stable and neutral atoms
						137	importance of atomic number
						137	build atomic models
						140	find the number of electrons in outermost level
						140	review subatomic particles

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2A.1.2 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the structure of the atom.	The student understands isotopes are atoms with the same atomic number (same number of protons) but different numbers of neutrons. The nuclei of some atoms are radioactive isotopes that spontaneously decay, releasing radioactive energy.	316	isotopes explained	133	exploring isotopes
				387	fusion and fission explained	136	understanding isotopes
				388	nuclear vs chemical reactions	138	fusion and fission
				623	nuclear fusion and the sun	138	nuclear reactions
						160	radioactive decay
						160	how do you simulate nuclear decay?

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2A.2.1 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the states and properties of matter.	The student understands chemists use kinetic and potential energy to explain the physical and chemical properties of matter on earth. Matter may exist in any of these three states: solids, liquids, and gases.	284	states of matter and arrangement of molecules	118	observe melting process and study quantitatively
				284	changes of state	118	investigate melting
				285	characteristics of matter related to its state	118	molecules in a liquid
				405	molecular structure of ice	119	investigate melting and create a graph
				451	temperature is a measure of average kinetic energy	119	adding heat energy to melt an ice cube
				451	increasing temperature means increasing motion of molecules	119	create a temperature vs. time graph of phase change
				452	molecular motion increases when temperature increases	119	energy and phase changes
				498	phases changes in the atmosphere	203	investigate the temperature/time curves as water is cooled through a phase change to ice
						204	compare the shape of the water line and the ice line on the temperature/time graph

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2A.2.2 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the states and properties of matter.	The student understands the periodic table lists elements according to increasing atomic number. This table organizes physical and chemical trends by groups, periods, and categories.	315	atomic number discussed	133	using the periodic table
				316	isotopes explained	133	exploring isotopes
				316	mass number discussed	133	identify mass number
				320	groups of elements	133	identify atomic number
				321	groups of elements and valence shells	133	identify element symbol and name
				321	studying the periodic table	136	building and studying the periodic table
				322	chemical symbols and element names	136	understanding isotopes
				322	atomic number on the periodic table	136	mass number
				322	mass number on the periodic table	136	atomic number
				322	atomic mass on the periodic table	141	build model of Na and Cl atoms and explain why they bond to form a molecule
				329	periodic table columns and valence electrons	142	arrangement of electrons and groups of elements
				330	bonding and periodic table position		
				332	periodic table and electronegativities		
				332	metals nonmetals and metalloids		
				335	periodic table and oxidation numbers		

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2A.2.3 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the states and properties of matter.	The student understands chemical bonds result when valence electrons are transferred or shared between atoms. Ionic compounds result from atoms transferring electrons. Molecular compounds result from atoms sharing electrons.	311	protons/neutrons/electrons	132	building atom models
				311	location/size/charge of subatomic particles	133	protons and neutrons
				318	proton/electron attraction	133	location of electrons in atom
				324	use the periodic table to predict chemical formulas	136	ions
				324	which element is more likely to combine with other elements?	136	model stable and neutral atoms
				335	chemical bonding and the periodic table	137	build atomic models
				388	showing valence electrons in a diagram	140	find the number of electrons in outermost level
						140	review subatomic particles
						141	whan an atom ionizes
						141	modeling a chemical bond
						143	ionic compounds

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2A.3.1 CHEMISTRY – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will gain a basic concept of chemical reactions.	The student understands a chemical reaction occurs when one or more substances react to form a different chemical substance(s) (products). There are different types of chemical reactions all of which demonstrate the Law of Conservation of Mass	353 physical and chemical changes and digestion 354 new substances are formed when a chemical change occurs 354 chemical reactions and digestion 355 physical and chemical changes in tire recycling 357 chemical reactions involve rearrangement of atoms 357 combustion reaction 359 balancing chemical equations 361 heartburn reaction 361 chemical reactions in living systems 363 history of law of conservation of mass 364 formation of petroleum is a very slow chemical reaction 371 which of the equations is balanced? 372 determine if changes are chemical or physical 375 synthesis or addition reactions	146 investigate and observe chemical and physical changes in the lab 148 reactants and products 149 balance these equations 149 practice balancing equations 150 investigate conservation of mass in effervescent tablet reaction 152 write the balanced equation 152 predict how much product formed given the reactants 156 investigate double displacement reactions 156 predict products in a double displacement reaction 158 investigate energy changes in chemical reactions 162 investigating combustion reactions

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				376	decomposition reactions
				377	single displacement reactions
				377	double displacement reactions
				378	consumer chemistry
				378	combustion reactions
				381	exothermic reactions and MREs
				381	MRE ration heater reaction
				382	endothermic reactions and cold packs
				395	chemistry of the atmosphere
				395	chemistry of the atmosphere
				397	carbon reactions
				438	chemical reactions and the formation of acid rain

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2B.1.1 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the relationships between force and motion.	The student understands Newton's Laws and the kinematic variables of time, position, velocity, and acceleration can be used to describe the position and motion of particles.	13 speed is relative 14 how to calculate speed 15 compare and contrast speed and velocity 18 what is the speed of an object that is standing still? 20 calculate speed of car 20 find speed of bumblebee 24 accurate speed measurements 25 conceptual models of motion 29 position vs. time graph discussion 30 position vs. time graphs 32 average speed vs. instantaneous 32 average speed discussed 33 understanding acceleration 35 how to calculate acceleration 36 examples of acceleration 37 speed vs. time graphs 37 speed vs. time graph discussion	8 calculating speed 9 collect data and calculate speed of car 10 calculate speed of the car 12 model the car's motion graphically 12 find speed of car at different positions 12 calculate speed of moving car 13 make a position vs. time graph 14 exploring acceleration on a ramp 14 calculate acceleration of car on ramp 14 calculate speed of car at two places on the ramp 14 acceleration is the rate at which speed changes 15 make a speed vs. time graph 15 changes in motion can be represented graphically 15 make a speed vs. time graph 16 unbalanced forces and acceleration of car 16 2nd law

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				42	17
				45	17
				45	19
				45	19
				46	20
				47	20
				48	20
				48	21
				49	22
				49	23
				49	24
				50	25
				51	27
				51	27
				52	
				52	

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				53	how to calculate weight		
				54	Newton's law of universal gravitation	36	find speed of marble
				55	calculating gravitational force between objects	257	relating the relationship between orbital speed and distance to the equation of universal gravitation
				56	friction explained		
				59	Newton's third law in detail		
				60	how to calculate momentum		
				60	law of conservation of momentum		
				64	solving problems using $f=ma$		
				64	calculate momentum		
				64	research effect of friction on human joints		
				67	how simple machines manipulate forces		
				69	how to calculate mechanical advantage		
				69	newtons and pounds		
				70	mechanical advantage of block and tackle		
				71	the human body and simple machines		
				71	parts of a lever		

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				71	
				71	
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				599	
				606	

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
2B.1.2 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the relationships between force and motion.	The student understands physicists use conservation laws to analyze the motion of objects.	60	law of conservation of momentum	38	identify potential/kinetic energy conversions
				91	following an energy transformation		
				537	potential energy transformed to kinetic energy causes earthquakes		
2B.2.1 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the conservation of mass and energy, and the First and Second Laws of Thermodynamics.	The student understands matter has energy. Mass and energy can be interchanged. The total energy in the universe is constant, but the type of energy may vary.	88	potential and kinetic energy explained	37	investigating conservation of energy with rollercoaster
				90	conservation of energy explained	38	explore energy transformations
				91	understand basic forms of energy	38	conservation of energy and energy transformations
				91	energy conversions		
				92	energy transformations and conservation	39	identify type of energy involved
				93	different forms of energy described		
				96	prove that energy is conserved		

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
2B.2.2 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the conservation of mass and energy, and the First and Second Laws of Thermodynamics.	The student understands the first Law of Thermodynamics states the total internal energy of a substance will change only if heat is exchanged with the environment or work is done on or by the substance.	83 how to calculate work 85 some input work is converted to heat 87 concept of energy as stored work 91 understand basic forms of energy 92 where does "spent" energy go? 96 explain the "lost" energy 96 calculate work done 97 compare different amounts of work done 97 calculate work accomplished by a motor 454 changes in temperature are directly related to changes in energy 460 thermal equilibrium 462 heat transfer through air 462 densely packed solids are good conductors of heat 463 warming hands over candle 463 convection currents and weather 464 convection currents in water	31 calculate work done on block 39 identify type of energy involved 119 investigate temperature and energy transfer in melting process 188 investigate the increase of temperature of water as thermal energy is added 191 calculating work input and work output 192 investigate convection in liquids

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				465 solid road surface emits radiation 465 transfer of heat by radiation 482 global warming and heat transfer by radiation 493 apply knowledge of heat transfer to different situations	
2B.2.3 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the conservation of mass and energy, and the First and Second Laws of Thermodynamics.	The student understands the Second Law of Thermodynamics states the entropy of a system isolated from transfer of matter and/or energy will not decrease.	84 work input and output	31 work output vs. work input

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
2B.3.1 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the nature of the fundamental interactions of matter and energy.	The student understands there are four fundamental forces in nature: strong nuclear force, weak nuclear force, electromagnetic force, and gravitational force.	52	gravity depends on mass	136	strong force
				54	Newton’s law of universal gravitation	257	relating the relationship between orbital speed and distance to the equation of universal gravitation
				55	calculating gravitational force between objects		
				106	electrical force is incredibly strong!		
				106	electrical forces		
				389	electromagnetic force		
				389	strong nuclear force		
				389	forces in the nucleus		
				606	Newton’s law of universal gravitation		

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2B.3.2 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the nature of the fundamental interactions of matter and energy.	The student understands waves have energy and can transfer energy when they interact with matter.	195	waves transmit energy	82	study wave pulses on elastic cord
				197	transverse and longitudinal waves	84	make different types of waves in a ripple tank
				201	reflection in water waves and light waves	85	observing reflection in water waves
				201	waves and reflection	87	investigating resonance
				201	waves and refraction	88	natural frequency and resonance of standing waves on a string
				201	waves and absorption	95	interference and sound waves
				202	refraction and eyeglasses	95	investigate interference with sound waves
				202	refraction and eyeglasses	96	investigating sound resonance
				204	resonance explained	100	study what makes light
				205	standing waves on a string	101	examine light through diffraction grating
				206	constructive and destructive interference	102	polarization of water waves
				210	can wave interference sink a ship?	102	polarization of a spring wave
				210	natural frequency of a building and earthquakes	103	polarization of light
				223	interference of sound waves	105	explore relationship between color and wavelength
				225	consonance and dissonance and beats	106	tracing incident and reflected rays
				234	what makes light?		
				240	polarization of light		
				242	color and frequency of light waves		

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				258	forming images with lenses	106	investigate reflection of light
				258	refraction in optical systems	107	investigate how light interacts with mirrors
				260	reflection and mirrors	107	plot reflected rays from a mirror
				261	refraction and lenses	108	tracing incident and refracted rays
				263	index of refraction	108	explore refraction with a prism
				263	index of refraction	108	investigate how light interacts with a prism
				264	human eye as an optical instrument	108	explore refraction with lenses
				273	find the angle of reflection	110	finding focal point and focal length of a lens
				480	absorption and emission	111	plotting images formed when light is refracted by a lens
				480	energy and radiation relationships	253	using a retractive telescope
				538	body waves	265	an element's spectral lines correspond to specific wavelengths of light
				626	the sun's energy reaches Earth in the form of electromagnetic waves		

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2B.3.3 PHYSICS – The student will develop an understanding of the structure of atoms, compounds, chemical reactions, and the interactions of energy and matter.	8 - 12	The student will understand the nature of the fundamental interactions of matter and energy.	The student understands electromagnetic waves result when a charged particle is accelerated or decelerated.	102 concept of electric circuits 103 circuit diagrams 105 charge is a fundamental property of matter 106 static charge discussed 107 explanation of coulomb 108 how an electroscope works 108 electroscopes 113 battery uses chemical energy to produce electrical charge 114 voltage is related to potential energy 145 series circuit defined 145 parallel circuit defined 146 household wiring 147 current and voltage in series circuits 151 voltage and resistance in parallel circuits 155 analyze a parallel circuit 156 analyze a series circuit 164 what is an electromagnet? 166 increased current vs. strength of magnetic field 166 building an electromagnet	42 investigate electric charge 45 battery chemicals and electrical charge 56 build a parallel circuit 56 build a series circuit 58 build a series circuit and find total resistance 60 parallel circuit and Ohm's law 66 build an electromagnet 67 find out what happens to strength of electromagnet when current is increased 100 study what makes light

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				196 waves are all around us	
				234 what makes light?	
				237 radio and television signals	
				237 microwave ovens	
				250 identify uses of electromagnetic waves	
				272 identify uses of electromagnetic waves	
				479 ultraviolet and infrared light	

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
4.1.1 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the sources of energy that power the subsystems and cycles of the dynamic Earth: the geosphere, hydrosphere, atmosphere and biosphere.	The student understands constructive and destructive processes dynamically reshape the surface of the Earth.	510	using maps to identify mountain ranges	229	using a globe to identify mountain ranges
				528	predicting what Earth might look like in 50 million years	230	predicting plate movement over 50 million years and the resultant land features
				534	land features resulting from divergent plate boundaries	240	estimating the effects of meteor impacts on Earth
				535	resulting land features from subduction	241	identifying which geologic features on Earth were caused by meteors
				536	land features resulting from transform plate boundaries		
				547	predict separation of North America and Europe in 75 million years		
				548	predict effects of divergent plate boundaries on Great Rift Valley		
				553	using a map to identify volcanoes		
				555	formation of Hawaiian Islands due to volcanic activity		
				558	volcanoes shape the Earth		
				562	constructive and destructive processes		
				563	mountain-building		

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				563 constructive process of mountain building 564 the destructive process of erosion 564 changes in land features due to erosion 565 formation of soil 565 wind erosion 566 effect of glaciers on land 576 the rock cycle	
4.1.2 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the sources of energy that power the subsystems and cycles of the dynamic Earth: the geosphere, hydrosphere, atmosphere and biosphere.	the student understands the Theory of Plate Tectonics explains that internal energy drives the Earth's ever changing structure.	525 formation of Earth's layers 526 description of Earth's layers 528 definition of plate tectonics 532 theory of plate tectonics 533 describing plate boundaries 534 divergent plate boundaries 535 convergent plate boundaries 536 transform plate boundaries 552 formation of magma in Earth's mantle	229 identifying tectonic plates and plate boundaries

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
4.1.3 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the sources of energy that power the subsystems and cycles of the dynamic Earth: the geosphere, hydrosphere, atmosphere and biosphere.	The student understands the ultimate source of atmospheric and oceanic energy comes from the Sun. Energy flow determines global climate and weather which is influenced by geographic features, cloud cover, and the earth's rotation.	480	transfer of energy in and out of Earth's atmosphere	185	effect of ocean on carbon dioxide levels in the atmosphere
				480	distribution of incoming solar radiation	202	investigate the temperature effects of greenhouse gases
				481	Earth's "energy budget"		
				481	greenhouse effect and greenhouse gasses	207	research how large bodies of water affect climate
				483	global temperature changing over time		
				485	computer modeling to predict greenhouse effects	213	exploring how temperature-dependent layering creates currents
				485	Earth's internal energy	223	research a particular biome
				491	Earth's temperature varies with latitude		
				493	convection currents in the atmosphere		
				494	the Coriolis effect		
				495	global wind patterns		
				496	effects of the Gulf Stream on climate of Great Britain		
				497	water in the atmosphere affects weather patterns		
				502	effects of moving air masses		
				502	cold fronts		
				503	warm fronts		

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				503 jet streams	
				504 rotation of air masses due to Coriolis effect	
				508 causes and effects of the El Nino Southern Oscillation	
				510 effect of cold ocean currents on formation of fog deserts	
				510 different types of deserts and how they are formed	
				511 how tropical rainforests are formed	
				511 effect of warm ocean currents on formation of tropical rainforest	
				513 effect of large bodies of water on climate	
				515 alpine tundra occurs at high altitudes	
				528 Earth's surface is changing	

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
4.2.1 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the origin and development of the dynamic Earth system.	The student understands geological time is used to understand the Earth's past.	522	relative dating	225	determining the relative ages of rock formations
				523	interpreting rock formations	226	sequencing events in a geologic cross-section
				523	faunal succession		
				524	table and description of the geologic time scale		
				566	ice ages		
				569	studying moon rocks on Earth		

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4.3.1 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of dynamics of our solar system.	The student understands gravitational attraction of objects in the solar system keeps solar system objects in orbit.	612	orbits of planets around the sun	256	simulate an object in orbit and investigate how orbital period varies within distance
				612	Johannes Kepler		
				613	Kepler's elliptically shaped orbits	258	setting up a scale model of the solar system
				613	explanation and illustration of the solar system	259	determining scale distances for the planets
				614	relative sizes and distances within the solar system	260	determining scale sizes of the planets
				616	classifying the planets		
				617	classifying the planets		
				618	comparing properties of the planets		
				619	asteroids and comets		
				620	meteors and meteorites and the Kuiper Belt		
				621	is Pluto a planet		

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4.3.2 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of dynamics of our solar system.	The student understands the relationship between the Earth, Moon, and Sun explains the seasons, tides and moon phases.	491	the effects of Earth's rotation on daytime heating and nighttime cooling	208	developing a hypothesis about why the seasons occur
				492	Earth's tilt causes seasons	209	investigating factors which cause the seasons
				492	Earth's tilt causes seasons	210	investigating how the distance of Earth from the sun affects its intensity
				518	create a model to explain why Earth has seasons		
				584	the lunar cycle	211	investigating how Earth's tilt affects the sun's intensity
				585	Earth's rotation and patterns of day and night		
				587	axial tilt causes the seasons	238	why studying the moon's surface is useful for understanding Earth
				588	solar eclipses		
				588	lunar eclipses	248	building a sundial to keep track of daily time based on the cycles between Earth and the sun
				589	solar eclipses		
				601	identify seasons	250	modeling the lunar cycle
				607	properties of the moon		
				608	the moon as a satellite of Earth	251	constructing a lunar calendar
				609	the moon's effect on tides on Earth		
				610	the Earth-moon system		
				611	giant impact theory		

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4.3.3 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of dynamics of our solar system.	The student understands the relative sizes and distances of objects in the solar system.	592	calculating and using light years	258	setting up a scale model of the solar system
				593	light years and time	259	determining scale distances for the planets
				613	explanation and illustration of the solar system	260	determining scale sizes of the planets
				614	relative sizes and distances within the solar system	268	calculating the distance to stars and galaxies using apparent brightness and absolute brightness
				616	classifying the planets		
				617	classifying the planets		
				618	comparing properties of the planets		
				621	is Pluto a planet		
4.3.4 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of dynamics of our solar system.	The student understands the Sun, Earth, and other objects in the solar system formed from a nebular cloud of dust and gas.	641	how the solar system was formed		

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4.4.1 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the organization of the universe and its development.	The student understands stellar evolution.	638 the life cycle of stars 639 death of small to medium stars results in white dwarfs and planetary nebula and black dwarfs 639 description and illustration of the life cycle of stars 640 death of massive stars results in supernovas and neutron stars and black holes 640 birth of elements 640 death of massive stars 640 elements formed by nuclear fusion in stars	255 observe and describe the appearance of the moon and Jupiter and its moons 264 using spectroscopy to analyze the light emitted by stars and identify most common elements

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4.4.2 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the organization of the universe and its development.	The student understands the current scientific explanation of the origin and structure of the universe.	591 characteristics of the universe 611 historical theories of the origin of the moon 612 historical theories about the solar system 621 historical theories of which objects were planets 633 what is a star? 642 what is a galaxy? 643 the structure of the Milky Way Galaxy 647 the Big Bang theory of the origin of the universe 648 evidence for the Big Bang theory 649 evidence for the Big Bang theory 652 research and describe astronomical objects	

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4.4.3 EARTH AND SPACE SCIENCE – The student will develop an understanding of energy in the Earth system, geochemical cycles, the formation and organization of the Earth system...	8 - 12	The student will develop an understanding of the organization of the universe and its development.	The student understands how the tools of astronomy have revolutionized the study of the universe.	594	history of the telescope	264	understand why spectroscopy is an important tool of astronomers
				595	types and uses of telescopes		
				596	types and uses of telescopes	268	measuring apparent brightness to calculate the distance to stars and galaxies
				597	satellites as tools of astronomy		
				598	spacecraft as tools of astronomy		
				634	the use of spectroscopy to analyze stars		
5.1.1 SCIENCE AND TECHNOLOGY – The student will develop understandings about the relationship between science and technology.	8 - 12	The student will develop an understanding that technology is applied science.	The student understands technology is the application of scientific knowledge for functional purposes.	73	relationship between science and technology	70	using engineering design cycle
				433	the clean water act		
				439	catalytic converters and scrubbing reduce acid rain		
				483	hydrogen powered cars		
				530	using echo sounders to map the sea floor		
				538	what we can learn from seismographs		
				544	understanding earthquakes allows engineers to design safer buildings		
				597	using satellite technology		
				599	space shuttle		

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5.1.2 SCIENCE AND TECHNOLOGY – The student will develop understandings about the relationship between science and technology.	8 - 12	The student will develop an understanding that technology is applied science.	The student understands creativity, imagination, and a broad scientific knowledge base are required to produce useful results.	34	Aristotle vs. Newton	130 investigate Rutherford's gold foil experiment
				45	Newton's Laws of Motion	
				54	Newton and the force of gravity	
				105	Benjamin Franklin	
				107	Charles-Augustin Coulomb	
				312	contributions of Fermi	
				313	development of atomic theory	
				321	contributions of Mendeleev	
				324	research and create a poster to illustrate development of atomic model	
				332	plate tectonic history	
				393	contributions of Marie and Pierre Curie	
				528	development of plate tectonic theory	
				529	continental drift theory	
				529	continental drift theory history	
				612	changing ideas about the solar system	
				648	development of Big Bang theory	

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5.1.3 SCIENCE AND TECHNOLOGY – The student will develop understandings about the relationship between science and technology.	8 - 12	The student will develop an understanding that technology is applied science.	The student understands science advances new technologies. New technologies open new areas for scientific inquiry.	73	relationship between science and technology	70	using engineering design cycle
				433	the clean water act		
				439	catalytic converters and scrubbing reduce acid rain		
				483	hydrogen powered cars		
				530	using echo sounders to map the sea floor		
				538	what we can learn from seismographs		
				544	understanding earthquakes allows engineers to design safer buildings		
				597	using satellite technology		
				599	space shuttle		

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6.1.1 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will develop an understanding of the overall functioning of human systems and their interaction with the environment in order to understand specific mechanisms and processes related to health issues.	The student understands some chemical and physical hazards and accidents can be avoided through safety education.	452 safety caution on heating jar	20 safety tip for car/ramp setup 24 ropes and pulley safety 26 safety tip for hanging weights from lever 40 electrical safety 44 short circuit safety warning 56 short circuit safety warning 58 short circuit safety warning 146 safety in the lab 150 chemistry safety 158 wear goggles and apron 168 safety equipment 172 hot water safety 180 safety tip for water testing 182 safety tips for observing Daphnia 186 thermometer safety 188 heat safety 192 heat safety 202 safety in greenhouse gas investigation 210 safety using light bulbs

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					216 safety in swinging thermometers		256 safety in lab
6.1.3 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will develop an understanding of the overall functioning of human systems and their interaction with the environment in order to understand specific mechanisms and processes related to health issues.	The student understands informed personal choices concerning fitness and health involve an understanding of chemistry and biology.	354	chemical reactions and digestion	162	importance of fossil fuels
				394	photosynthesis and carbon reactions	162	structure of fossil fuels
				395	fossil fuels and carbon reactions		

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6.3.1 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will understand that human populations use natural resources and influence environmental quality.	The student understands natural resources from the lithosphere and ecosystems are required to sustain human populations.	394	photosynthesis and carbon reactions	162	importance of fossil fuels
				395	fossil fuels and carbon reactions	162	structure of fossil fuels
				433	water quality standards	198	detecting ozone which is a protective atmosphere gas against high energy radiation
				434	importance of water analysis		
				439	illustration of acid rain formation		
				440	oceans in the water cycle		
				440	oceans as part of the hydrosphere		
				471	composition of Earth's atmosphere		
				471	description of Earth's atmosphere		
				472	effect of life on Earth's atmosphere		
				477	ozone layer		
				477	layers of the atmosphere		
				478	layers of the atmosphere		
				479	ozone depletion		
				482	changes to the oceans due to increasing global temperatures		
				485	Earth's internal energy		
				559	volcanoes and water vapor		

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				568	how urban sprawl changes local climate	
6.3.2 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will understand that human populations use natural resources and influence environmental quality.	The student understands Earth does not have infinite resources.	414	effect of electrical generating facilities on dissolved oxygen in water	
				433	wise use of water	
				435	water usage and quality	
				440	oceans in the water cycle	
				443	impact of increased CO2 in oceans	
				479	effects of CFC's on the ozone layer	
				482	effects of burning fossil fuels	
				515	permafrost	
				542	using seismic waves for oil and gas exploration	
				559	volcanoes and water vapor	
				560	mineral deposits and diamonds	
					163	can trees compensate for manmade CO2 from vehicles and industry?
					164	perform water quality tests
					178	predict the quality of surface water to be tested and justify your answer
					178	wise use of water supply
					180	perform water quality tests

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6.4.1 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will understand the effect of natural and human- influenced hazards.	The student understands natural processes of earth may be hazardous for humans.	387	fusion and fission explained	138	fusion and fission
				388	nuclear vs chemical reactions	138	nuclear reactions
				437	acid rain explained	160	radioactive decay
				448	research the issue of acid rain	160	how do you simulate nuclear decay?
				518	write an action plan to stay safe during a tornado	182	investigate effect of acid rain on microorganisms
				537	causes and descriptions of earthquakes	219	describe what safety precautions the National Weather Service recommends for tornado conditions
				537	earthquakes and plate tectonics	236	understanding the Volcanic Explosivity Index
				539	earthquakes rating scales		
				552	geologic basis for volcanic eruptions		
				552	formation of magma in Earth's mantle		
				553	where volcanic activity occurs		
				554	types and shapes of volcanoes		
				555	shield volcanoes		
				555	geologic basis for shield volcanoes		
				556	geologic basis for stratovolcanoes		
				556	stratovolcanoes		

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				557 geologic bases for cinder cone volcanoes	
				623 nuclear fusion and the sun	

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6.4.2 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will understand the effect of natural and human- influenced hazards.	The student understands there is a need to assess potential risk and danger from natural and human-induced hazards	379	hydrogen-powered cars and the environment	20	safety tip for car/ramp setup
				395	fossil fuels	24	ropes and pulley safety
				411	effects of PCB's in Great Lakes	26	safety tip for hanging weights from lever
				414	effect of electrical generating facilities on dissolved oxygen in water	40	electrical safety
						44	short circuit safety warning
				433	The Clean Water Act	56	short circuit safety warning
				435	water quality testing	58	short circuit safety warning
				436	effect of excess nitrates on environment		
				436	water quality testing	146	safety in the lab
				437	acid rain explained	150	chemistry safety
				437	acid rain	158	wear goggles and apron
				437	effects of acid rain on the soil	160	radioactive decay
				437	acid rain	163	too much CO2
				438	causes and health effects of acid rain	168	safety equipment
				444	pollution and the ocean food chain	172	hot water safety
				445	pollution and the ocean food chain	178	predict the quality of surface water to be tested and justify your answer
				448	research the issue of acid rain	179	address what you can do to maintain or improve the water quality at the test site
452	safety caution on heating jar	180	safety tip for water testing				

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page		
				504	temperature inversion	182	safety tips for observing Daphnia
				518	write an action plan to stay safe during a tornado	182	the effects of acid rain on organisms in aquatic environments
				537	earthquakes and plate tectonics	182	investigate effect of acid rain on microorganisms
				537	causes and descriptions of earthquakes	182	the effects of acid rain on organisms in aquatic environments
				539	earthquakes rating scales		
				540	where earthquakes occur		
				541	earthquake hazard map	186	thermometer safety
				552	geologic basis for volcanic eruptions	188	heat safety
				552	formation of magma in Earth's mantle	192	heat safety
				552	formation of magma in Earth's mantle	202	safety in greenhouse gas investigation
				553	where volcanic activity occurs	210	safety using light bulbs
				554	types and shapes of volcanoes	216	safety in swinging thermometers
				555	shield volcanoes	219	describe what safety precautions the National Weather Service recommends for tornado conditions
				555	geologic basis for shield volcanoes		
				556	stratovolcanoes		
				556	geologic basis for stratovolcanoes	228	reading a bathymetric map
				557	geologic bases for cinder cone volcanoes	229	using a geologic hazard map of frequent earthquakes
				567	geologic hazard maps	236	understanding the Volcanic Explosivity Index

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				580 using a geologic hazard map	256 safety in lab

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6.5.1 SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES – The student will develop an understanding of personal and community health, population growth, natural resources, environmental quality...	8 - 12	The student will develop an understanding of the relationship between science, technology, and society.	The student understands progress in science and technology can be affected by social issues and challenges. Science and technology indicate what can happen, not what should happen.	73	relationship between science and technology	70	using engineering design cycle
				320	the quests of alchemists	198	contributions of Schönbein
				391	scientific discovery and the atomic age		
				433	the clean water act		
				439	catalytic converters and scrubbing reduce acid rain		
				483	hydrogen powered cars		
				530	using echo sounders to map the sea floor		
				538	what we can learn from seismographs		
				544	understanding earthquakes allows engineers to design safer buildings		
				583	history of calendars		
				585	counting the days in a year		
				586	the history of clocks and the division of time		
				589	ancient beliefs about solar eclipses		
				594	history of the telescope		
				597	using satellite technology		
				599	space shuttle		

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7.1.1 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student demonstrates an understanding of science as both vocation and avocation.	214	ultrasound technology	177	chemistry and photography
				220	voice recognition technology	178	water quality specialist
				294	invention of Kevlar	178	water quality testing
				452	civil engineers and bridge design	222	zoo exhibit designers
				457	engineers design better products when they know specific heat		
				542	seismologists		
				548	describe the work of a geologist and paleontologist and seismologist		
				561	volcanologists		

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7.1.2 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student explains how science uses peer review, replication of methods, and norms of honesty.	20	how will speed change?	11	calculate % error
				24	predicting speed from a graph	76	use data to predict best string length for a pendulum clock
				42	predict the speed of a car	76	calculate % error
				485	what percentage comes from this source? (problem 4)	121	use graph to predict mass of six objects
				543	determining distance to an epicenter	151	does your experiment agree with law of conservation of mass?
				547	what explains the difference in density? (#5)	156	make predictions about solubility
				605	how big is Earth?	197	calculating error between your barometer and a commercial barometer
						199	importance of good record keeping in order to avoid error
						201	predicting areas with high ozone concentration based on your data
						204	predicting what would happen if you place your ice/water test tube into a hot cup or a cold cup
						231	evaluating your completed bathymetric map

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					239 estimating the number of meteor collisions on Earth during the last 3.5 billion years 242 predicting the results of the crystal-growing experiment 247 evaluate your ability to interpret rock formations
7.1.3 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student recognizes the universality of basic science concepts and the influence of personal and cultural beliefs that embed science in society.	34 Newton’s research impacted mathematics 73 impact of technology 73 impact of Da Vinci’s work 320 the quests of alchemists 391 scientific discovery and the atomic age 542 studying seismic waves leads to information used in oil and gas exploration 545 predicting tsunamis 583 history of calendars 585 counting the days in a year 586 the history of clocks and the division of time 589 ancient beliefs about solar eclipses 594 history of the telescope	163 evaluating choice of favorite car 198 contributions of Schönbein

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
7.1.4 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student recognizes that society helps create the ways of thinking required for scientific advances, both toward training scientists and educating a populace to utilize benefits of science.	58	Newton on a skateboard	39	study energy transformations in daily life scenarios
				73	impact of Da Vinci’s work		
				78	describe a problem that would be solved by an engineer	179	researching and preparing for a field trip to test surface water
				120	circuits in your house	198	contributions of Schönbein
				320	the quests of alchemists		
				391	scientific discovery and the atomic age	201	suggesting ways that ozone concentrations could be reduced
				452	balloons expands or contracts due to thermal expansion	204	connecting the latent heat investigation to Earth
				454	temperature vs. thermal energy for a cup or pot of soup	218	understanding Doppler radar
				461	understanding thermal energy through cocoa example		
				465	examples of reflectors and absorbers		
				473	why do ears pop		
				476	atmospheric pressure in Denver		
				490	using the North Star to estimate your latitude		
				509	how do animals survive in the desert		
				536	analogy of plate movements		

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				583 history of calendars 585 counting the days in a year 586 the history of clocks and the division of time 589 ancient beliefs about solar eclipses 594 history of the telescope	
7.1.5 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student understands there are many issues which involve morals, ethics, values or spiritual beliefs that go beyond what science can explain, but for which solid scientific literacy is useful.	320 the quests of alchemists 391 scientific discovery and the atomic age 583 history of calendars 585 counting the days in a year 586 the history of clocks and the division of time 589 ancient beliefs about solar eclipses 594 history of the telescope	163 evaluating choice of favorite car 198 contributions of Schönbein

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7.1.6 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding that science is a human endeavor that uses models to describe and explain the physical universe.	The student recognizes society's role in supporting topics of research and determining institutions where research is conducted.	34	Newton's research impacted mathematics	
				73	impact of technology	
				73	impact of Da Vinci's work	
				542	studying seismic waves leads to information used in oil and gas exploration	
				545	predicting tsunamis	
7.2.1 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding of the nature of scientific knowledge.	The student understands scientific knowledge describes and explains the natural world.	473	why do ears pop	6 asking questions and learning about natural world
				504	meteorologists use atmospheric pressure data to understand movement of weather systems	215 the food paradox of the oceans
				648	evidence for Big Bang theory	

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
7.2.2 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding of the nature of scientific knowledge.	The student understands scientific knowledge begins with empirical observations, which are the data upon which further scientific knowledge is built.	5	measuring distance	5	measuring metric and english lengths
				42	analyze a speed/distance graph	6	compare results with other groups
				372	observe chemical changes	6	measure time
				435	making observations and asking questions	11	analyze speed change of car
				463	convection and sea breezes	11	graph speed vs. position
				486	observing an aurora	14	record three different time intervals
				489	patterns of heating and cooling on Earth	16	measure force
				508	patterns in storm activity across the globe	18	study data table for relationship between force and motion
				533	patterns of earthquakes and volcanoes	25	analyze block and tackle data
				540	boundaries of tectonic plates	25	collect force data
				553	the Ring of Fire	27	analyze lever equilibrium data
				584	lunar cycles	27	write down the number of weights you use
				609	tides		
				630	use the data to answer the questions	35	does data support hypothesis?
				630	what evidence was used to predict the existence of the Kuiper Belt?	44	measure voltage
						45	did battery voltage change?
				637	categorizing stars with H-R diagrams	46	measure current
						48	measure resistance

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
				652 analysis with a spectrometer (#4)	76 analyze pendulum data 87 measure wavelength 100 observe glow-in-the-dark paper 116 measure mass 117 measure volume 146 observe evidence of chemical change 146 record detailed observations 147 students analyze chemical change lab results 150 record data as you perform experiment 158 observe temperature changes in chemical reactions 169 observe Tyndall effect 172 observe dissolving process 179 make observations about local surface water 182 observing daphnia and recording movements and behavior 186 sensing temperature with fingers 186 measure temperature

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					192 observe convection currents
					192 observing forced convection through liquids
					197 evaluating the relationship between atmospheric pressure and weather
					199 collecting Schönbein strips for detecting ozone
					202 using your hand to sense temperature differences
					202 collecting data of temperature and sensations
					206 collecting temperature and time data
					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

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page		Volume 2 Investigation Manual Page	
7.2.3 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding of the nature of scientific knowledge.	The student understands scientific knowledge consists of hypotheses, inferences, laws, and theories.	9	steps in the scientific method	6	predict which car will move fastest
				10	forming a hypothesis	7	compare results with hypothesis
				10	process of reviewing hypothesis explained	7	test the effect of one other variable
				19	design your own experiment	9	devise a hypothesis
				448	describe steps you would take to determine whether pH affects frog population	27	think about the variables
				451	what is temperature	34	where does the marble move the fastest?
				521	relative dating and modern geology based on Steno's theories	39	review energy theory in context of everyday scenarios
				528	theory of plate tectonics	43	how did A and B tapes acquire different charge?
				530	proving hypotheses for sea-floor spreading	75	investigate variables that affect the period of a pendulum
				563	Darwin's theories of the Andes formation	75	plan three experiments to determine which variable affects the period of a pendulum
				566	what causes ice ages		
				580	form a hypothesis (#7)	151	review your hypothesis
				611	theories of origin of the moon	151	perform the experiment you designed
				647	Big Bang theory	151	explain how hypothesis compares to results
						170	devise hypothesis and explain

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					<p>170 which method will give fastest dissolving rate?</p> <p>170 which factor will produce fastest dissolving rate?</p> <p>170 devise hypothesis and explain</p> <p>171 did you prove or disprove your hypothesis?</p> <p>182 formulate hypothesis</p> <p>208 testing hypothesis of why seasons occur against your observations in the investigation</p> <p>208 formulate a hypothesis about why the seasons occur</p> <p>237 develop a research plan for studying volcanoes</p>

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7.2.4 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will develop an understanding of the nature of scientific knowledge.	The student understands a testable hypothesis or inference must be subject to confirmation by empirical evidence.	5	measuring distance	4	difference between precise and accurate data
				12	importance of reliable and accurate data collection	5	measuring metric and english lengths
				42	analyze a speed/distance graph	6	electronic timer and release technique
				435	making observations and asking questions	6	measure time
				486	observing an aurora	6	compare results with other groups
				630	use the data to answer the questions	7	record time interval
				630	what evidence was used to predict the existence of the Kuiper Belt?	9	collect speed data
				630	what evidence was used to predict the existence of the Kuiper Belt?	11	analyze speed change of car
				652	analysis with a spectrometer (#4)	11	graph speed vs. position
						14	record three different time intervals
						16	measure force
						17	record times
						18	study data table for relationship between force and motion
						24	collect weight data
						25	analyze block and tackle data
						25	collect force data
						27	write down the number of weights you use

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Standard #: Standard	Grade Level	Benchmark	Indicator	Volume 1 Student Text Page	Volume 2 Investigation Manual Page
					27 analyze lever equilibrium data
					35 does data support hypothesis?
					36 collect precise speed and height data
					44 measure voltage
					45 did battery voltage change?
					46 measure current
					48 measure resistance
					75 collect mass and amplitude data
					76 analyze pendulum data
					87 measure wavelength
					116 measure mass
					117 measure volume
					146 record detailed observations
					147 students analyze chemical change lab results
					150 record data as you perform experiment
					151 do the data support the hypothesis
					171 collect time data and record observations

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					171 what was happening at molecular level?
					182 making detailed observations
					182 observing daphnia and recording movements and behavior
					184 collecting pH readings while adding carbon dioxide
					186 collecting temperature data
					186 measure temperature
					189 collecting time and temperature data
					193 collecting and recording time and temperature data
					199 collecting Schönbein strips for detecting ozone
					202 collecting data of temperature and sensations
					206 collecting temperature and time data
					210 collecting qualitative data of light intensity at scale distance from the sun
					217 collecting wet and dry bulb temperature readings

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					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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7.3.1 HISTORY AND NATURE OF SCIENCE – The student will develop understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives.	8 - 12	The student will understand science from historical perspectives.	The student demonstrates an understanding of the history of science.	34	Newton and the history of physics	130 investigate Rutherford's gold foil experiment
				34	Aristotle vs. Newton	
				45	Newton's Laws of Motion	
				45	Newton's discovery of the 2nd law	
				45	Newton's Principia	
				46	oldest known standard weight	
				54	Newton and the force of gravity	
				55	Newton and the apple legend	
				73	Leonardo DaVinci	
				86	James Watt	
				105	Benjamin Franklin	
				107	Charles-Augustin Coulomb	
				115	Volta's batteries	
				131	Georg Ohm's work with circuits	
				134	history of superconductivity	
				160	Faraday's contributions	
				161	history of magnetism	
				312	history of atomic theory	
				312	contributions of Fermi	

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				312 Dalton's contributions	
				313 development of atomic theory	
				321 Mendeleev's periodic table	
				321 contributions of Mendeleev	
				324 research and create a poster to illustrate development of atomic model	
				332 Linus Pauling and electronegativities	
				343 Avogadro's number	
				363 history of law of conservation of mass	
				363 Antoine Lavoisier	
				393 Marie and Pierre Curie	
				393 history of nuclear chemistry	
				393 contributions of Marie and Pierre Curie	
				393 accomplishments of Marie Curie	
				455 contributions of Joule	
				457 Joseph Black	