

Correlation to Georgia Performance Standards: Science (revised 2006)

CPO Science Physics: A First Course

Student Text and Investigation Manual

Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh1.a High School Science	Characteristics of Science: Habits of Mind	Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	Exhibit the above traits in their own scientific activities.	8 asking a scientific question 11 importance of units 11 communicating via measurement 22 unexpected discoveries 23 science is a creative enterprise 26 applying your knowledge: three opportunities to research topics and write reports 132 explain your answer using diagrams 132 applying your knowledge: two opportunities to research topics and write reports 163 applying your knowledge: two opportunities to research topics and write reports 186 creativity and discoveries of Charles Goodyear 295 applying your knowledge: three opportunities to research topics and write reports	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation

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Standard #: Course	Co-Requisite	Standard	Learning Goal		Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh1.b High School Science	Characteristics of Science: Habits of Mind	Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	Recognize that different explanations often can be given for the same evidence.	8	cause and effect relationships	6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 60 propose a relationship between power and voltage
SCSh1.c High School Science	Characteristics of Science: Habits of Mind	Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.	4 8 8 22	what is an experiment designing experiments scientific method scientific method in action	4 use photogate A to monitor repeatability 27 practice your technique until it is repeatable 47 design an experiment 94 design pendulum experiments

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page		
SCSh2.a High School Science	Characteristics of Science: Habits of Mind	Students will use standard safety practices for all classroom laboratory and field investigations.	Follow correct procedures for use of scientific apparatus.	171	how a thermometer works	2	using timers and photogates
				305	using a multimeter to measure current	6	reflecting on the experiment
				307	using a multimeter to measure resistance	7	construct explanations supported by evidence
						9	how do your observations support your answer?
						11	what experimental data support answer?
						22	use spring scales
						44	using a timer and photogates
						46	using a timer and photogates
						47	construct a reasonable explanation
						59	use a multimeter
60	propose a relationship between power and voltage	61	using a multimeter to measure resistance				
62	use a multimeter to measure current	63	use a multimeter to measure resistance of a pot				

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					64 use a multimeter to measure voltage drop 65 use a multimeter to measure voltage 66 use a multimeter to measure current 74 use a multimeter to measure voltage 85 use a multimeter to measure voltage 86 use a timer and photogate to measure speed of rotor 93 use a timer and photogate to measure the period of a pendulum 96 use a timer and photogate to measure the natural frequency of an oscillator

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page		
SCSh2.b High School Science	Characteristics of Science: Habits of Mind	Students will use standard safety practices for all classroom laboratory and field investigations.	Demonstrate appropriate techniques in all laboratory situations.	11	understand length measurement	1	mixed units for time
				12	systems of measurement	1	collect accurate, precise data with electronic timer
				13	time measurement units	7	collect precise data
				14	basic unit of time	8	make mass measurements
				29	measuring mass	10	make length measurement
				30	measuring force	12	record the times
						14	measure mass of car
						17	measure string length
						19	measure the force
						22	measure force
		23	measure the mass				
		24	measure the time				
		27	how can photogate ensure consistent results?				
		28	measure height of track				
		33	measure mass of ice and cup				
		44	measure mass of car				
		44	make a precise time measurement				
		46	measure mass of car				
		50	measure volume				
		50	measure mass				

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
					61 collect and record resistance data 76 measure mass of capacitor 78 estimate the precision of measurements
SCSh2.c High School Science	Characteristics of Science: Habits of Mind	Students will use standard safety practices for all classroom laboratory and field investigations.	Follow correct protocol for identifying and reporting safety problems and violations.		16 safety with simple machines 48 demonstrate safe lab practices 67 short circuits and lab safety 70 capacitor safety
SCSh3.a High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Suggest reasonable hypotheses for identified problems.	8 formulating a hypothesis 8 hypothesis defined	6 form a hypothesis 30 state a hypothesis about the water's energy 94 state a hypothesis about period of pendulum 96 state a hypothesis about the natural frequency of the oscillator
SCSh3.b High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Develop procedures for solving scientific problems.	4 what is an experiment 8 designing experiments	47 design an experiment 94 design pendulum experiments

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh3.c High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Collect, organize and record appropriate data.		1 collect accurate, precise data with electronic timer 6 use a data table 7 collect precise data 8 constant force data table 9 constant height data table 10 speed data table 13 collision data table 18 output and input work data table 19 force vs. distance data table 22 force data table 25 rolling friction data table 27 how can photogate ensure consistent results? 29 speed and height data table 61 collect and record resistance data 78 estimate the precision of measurements 154 create a data table

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Standard #: Course	Co-Requisite	Standard	Learning Goal		Volume One Student Text Page	Volume Two Investigation Manual Page	
SCSh3.d High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Graphically compare and analyze data points and/or summary statistics.	16	constructing graphs	4	construct a graph
				16	steps to follow for graph construction	11	create a graph
				25	constructing a graph	15	graph speed vs. height
				46	motion graphs	20	graph work done vs. deflection of rubber band
				48	motion graphs	21	graph speed vs. rubber band deflection
				112	using a graph to find force vector components	25	graph friction vs. mass
				419	harmonic motion graphs	27	graph launch angle vs. range
				420	finding the amplitude on a harmonic motion graph	29	graph acceleration vs. steepness ratio
						45	make a graph of efficiency vs. speed
						50	graph time vs. temperature
		52	construct a graph				
		75	graph current vs. time for the capacitor				
		86	graph voltage vs. speed				
		94	sketch harmonic motion graphs				

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh3.e High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Develop reasonable conclusions based on data collected.		6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 52 find a percentage 60 propose a relationship between power and voltage
SCSh3.f High School Science	Characteristics of Science: Habits of Mind	Students will identify and investigate problems scientifically.	Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.		6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 60 propose a relationship between power and voltage

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page			
SCSh4.a High School Science	Characteristics of Science: Habits of Mind	Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.	Develop and use systematic procedures for recording and organizing information.	11	importance of units	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation		
				11	communicating via measurement			
				26	applying your knowledge: three opportunities to research topics and write reports			
				132	explain your answer using diagrams		6	use a data table
				132	applying your knowledge: two opportunities to research topics and write reports		8	constant force data table
				132	applying your knowledge: two opportunities to research topics and write reports		9	constant height data table
				10	speed data table			
				13	collision data table			
				18	output and input work data table			
				19	force vs. distance data table			
22	force data table							
25	rolling friction data table							
29	speed and height data table							
154	create a report							
154	create a data table							

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh4.b High School Science	Characteristics of Science: Habits of Mind	Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.	Use technology to produce tables and graphs.		computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation 150 using computer spreadsheets

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page			
SCSh4.c High School Science	Characteristics of Science: Habits of Mind	Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.	Use technology to develop, test, and revise experimental or mathematical models.	16	constructing graphs	computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation		
				16	steps to follow for graph construction			
				25	constructing a graph			
				46	motion graphs		4	construct a graph
				48	motion graphs		11	create a graph
				112	using a graph to find force vector components		15	graph speed vs. height
				419	harmonic motion graphs		20	graph work done vs. deflection of rubber band
				420	finding the amplitude on a harmonic motion graph		21	graph speed vs. rubber band deflection
							25	graph friction vs. mass
							27	graph launch angle vs. range
		29	graph acceleration vs. steepness ratio					
		45	make a graph of efficiency vs. speed					
		50	graph time vs. temperature					
		52	construct a graph					
		75	graph current vs. time for the capacitor					
		86	graph voltage vs. speed					
		94	sketch harmonic motion graphs					

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
					150 using computer spreadsheets
SCSh5.a High School Science	Characteristics of Science: Habits of Mind	Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	Trace the source on any large disparity between estimated and calculated answers to problems.	10 what is a model	3 car launching technique is a possible source of error 4 car launching technique is a possible source of error 21 how close is your prediction to the actual measurement? 26 spotting the landing point of the marble is tricky 27 marble launching technique is a possible source of error 31 did result agree with hypothesis? 52 find a percentage
SCSh5.b High School Science	Characteristics of Science: Habits of Mind	Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	Consider possible effects of measurement errors on calculations.		3 car launching technique is a possible source of error 4 car launching technique is a possible source of error 21 how close is your prediction to the actual measurement? 26 spotting the landing point of the marble is tricky 27 marble launching technique is a possible source of error

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh5.c High School Science	Characteristics of Science: Habits of Mind	Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	Recognize the relationship between accuracy and precision.	10 what is a model	1 collect accurate, precise data with electronic timer 3 car launching technique is a possible source of error 4 car launching technique is a possible source of error 7 collect precise data 21 how close is your prediction to the actual measurement? 26 spotting the landing point of the marble is tricky 27 marble launching technique is a possible source of error 27 how can photogate ensure consistent results? 78 estimate the precision of measurements
SCSh5.d High School Science	Characteristics of Science: Habits of Mind	Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.	featured throughout CPO Science program featured in ancillary component	featured throughout CPO Science program

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page		
SCSh5.e High School Science	Characteristics of Science: Habits of Mind	Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.	Solve scientific problems by substituting quantitative values, using dimensional analysis, and/or simple algebraic formulas as appropriate.	15	setting up unit conversions	11	find formula for acceleration
				19	mathematical descriptions	13	derive a formula
				26	interpreting distance/time graph	17	calculate mechanical advantage
				34	mathematical model of acceleration	17	derive a formula to use with ropes and pulleys
				35	Newton's second law equation	29	find a mathematical name for the steepness ratio
				41	average speed equation	29	calculate the ratio
				43	calculating weight	31	calculate temperature of mixture
				61	momentum equation	69	calculate power used by the bulb
				62	relating impulse and momentum conservation	75	derive a formula to calculate the charge
				68	kinetic energy formula	76	calculate the number of electrons
				86	the work equation	99	calculate natural frequency and period
				89	the power equation	154	calculate gear ratio
				96	calculating mechanical advantage		
				118	Hooke's law equation		
				141	projectile motion problems		
				143	calculating angular speed		
				144	finding the circumference of a circle		
				145	linear speed equation		
				153	equation for law of universal gravitation		

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
				179	
				the heat equation	
				193	
				density formula	
				208	
				pressure and temperature relationship	
				308	
				equation for Ohm's law	
				342	
				equation for Coulomb's law	
				438	
				calculating wave speeds	
				439	
				equation for the speed of a wave	
				525	
				equation for the speed of light	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page	
SCSh6.a High School Science	Characteristics of Science: Habits of Mind	Students will communicate scientific investigations and information clearly.	Write clear, coherent laboratory reports related to scientific investigations.	11	importance of units	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation 154 create a report
				11	communicating via measurement	
				26	applying your knowledge: three opportunities to research topics and write reports	
				132	explain your answer using diagrams	
				132	applying your knowledge: two opportunities to research topics and write reports	
163	applying your knowledge: two opportunities to research topics and write reports					
295	applying your knowledge: three opportunities to research topics and write reports					
SCSh6.b High School Science	Characteristics of Science: Habits of Mind	Students will communicate scientific investigations and information clearly.	Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.	72	energy usage and conservation	112 research how computer monitors and televisions make colros
				104	prosthetic legs and technology	161 making a model maglev train
				122	maglev train technology	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh6.c High School Science	Characteristics of Science: Habits of Mind	Students will communicate scientific investigations and information clearly.	Use data as evidence to support scientific arguments and claims in written or oral presentations.		<p>6 reflecting on the experiment</p> <p>7 construct explanations supported by evidence</p> <p>9 how do your observations support your answer?</p> <p>11 what experimental data support answer?</p> <p>47 construct a reasonable explanation</p> <p>60 propose a relationship between power and voltage</p>

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh6.d High School Science	Characteristics of Science: Habits of Mind	Students will communicate scientific investigations and information clearly.	Participate in group discussions of scientific investigation and current scientific issues.	11 importance of units 11 communicating via measurement 26 applying your knowledge: three opportunities to research topics and write reports 132 explain your answer using diagrams 132 applying your knowledge: two opportunities to research topics and write reports 163 applying your knowledge: two opportunities to research topics and write reports 295 applying your knowledge: three opportunities to research topics and write reports	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation
SCSh7.a High School Science	Characteristics of Science: The Nature of Science	Students will analyze how scientific knowledge is developed. Students will recognize that:	The universe is a vast single system in which the basic principles are the same everywhere.	23 science helps us learn about natural world	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SCSh7.b High School Science	Characteristics of Science: The Nature of Science	Students will analyze how scientific knowledge is developed. Students will recognize that:	Universal principles are discovered through observation and experimental verification.	8 scientific method 11 measurement 12 metric system 13 measuring time 22 scientific method in action	
SCSh7.c High School Science	Characteristics of Science: The Nature of Science	Students will analyze how scientific knowledge is developed. Students will recognize that:	From time to time, major shifts occur in the scientific view of how the world works.	22 discovery of Penicillin 22 Fleming's investigations 28 Newton's idea of force 167 history of atomic theory 218 atomic theory 219 development of atom models 224 development of periodic table	
SCSh7.d High School Science	Characteristics of Science: The Nature of Science	Students will analyze how scientific knowledge is developed. Students will recognize that:	Hypotheses often cause scientists to develop new experiments that produce additional data.	8 scientific method 22 scientific method in action	

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SCSh7.e High School Science	Characteristics of Science: The Nature of Science	Students will analyze how scientific knowledge is developed. Students will recognize that:	Testing, revising, and occasionally rejecting new and old theories never ends.		6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 60 propose a relationship between power and voltage
SCSh8.a High School Science	Characteristics of Science: The Nature of Science	Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	Scientific investigators control the conditions of their experiments in order to produce valuable data.	6 what is a variable 8 control and experimental variables 8 dependent variables 8 independent variables 16 graphs and dependent variables 16 graphs and independent variables 24 importance of changing one variable at a time in an experiment	6 recognize and control variables 27 identify and control variables 94 investigate variables and how they affect the period of a pendulum

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SCSh8.c High School Science	Characteristics of Science: The Nature of Science	Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.	22 unexpected discoveries 23 science is a creative enterprise 186 creativity and discoveries of Charles Goodyear	4 use photogate A to monitor repeatability 27 practice your technique until it is repeatable
SCSh8.d High School Science	Characteristics of Science: The Nature of Science	Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	The merit of a new theory is judged by how well scientific data are explained by the new theory.		6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 60 propose a relationship between power and voltage
SCSh8.e High School Science	Characteristics of Science: The Nature of Science	Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.	19 mathematical models 23 science helps us learn about natural world	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page		
SCSh8.f High School Science	Characteristics of Science: The Nature of Science	Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:	Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.	53	relationship between science and technology	89	connection to earth science: gravitational fields
				78	rocket technology	111	connection to life science: photoreceptors in the eye
				79	new technologies	167	building a sundial: earth science connection
				213	deep water submarine technology		
				235	technology and archaeology		
				273	how a smoke detector works		
				458	recording sound		
532	applications of polarization						

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SP1.a Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Calculate average velocity, instantaneous velocity, and acceleration in a given frame of reference.	17	nothing in the universe stays still	3	find the speed of the car
				17	speed of light	6	how can speed be measured?
				17	constant speed	7	measure the speed
				17	speed defined	9	why did the speed change?
				17	comparing speeds	10	find speed of car
				18	speed units	11	investigating net force and acceleration
				18	calculating speed	21	measure speed of car
				19	velocity defined	25	calculate speed of car
				32	acceleration defined	44	experiment and find average speed
				33	acceleration and velocity	46	measure speed of car
				40	velocity defined	53	investigate frames of reference
				45	skydiving and terminal speed	54	identify frame of reference
				45	terminal speed		
				56	calculate speed from distance/time graph		
				136	speed vs. velocity		
				143	angular speed		
SP1.b Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Compare and contrast scalar and vector quantities.	111	force vectors	23	draw a free body diagram
				112	resolving vectors	23	use force vectors
				113	using a free-body diagram		
				115	finding resultant vector		
				136	working with velocity vector		

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SP1.c Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Compare graphically and algebraically the relationships among position, velocity, acceleration, and time.	46 position vs. time graphs 47 position vs. time graph for accelerating motion 48 speed vs. time graph 49 speed vs. time graph for accelerating motion 51 finding distance from a speed vs. time graph 134 understanding displacement	4 position vs. time graph 11 speed vs. time graph

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SP1.d Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Measure and calculate the magnitude of frictional forces and Newton's three Laws of Motion.	29 35 35 36 37 45 52 59 60 78 94 101 117 119 119 120 122 123 128 158	Newton's first law Newton's second law quantitative understanding of second law applying Newton's second law properly using second law formula effects of air resistance action-reaction pairs Newton's third law sorting out force pairs third law and rockets friction and machines friction explained Newton's third law and springs friction explained cause of friction static and sliding friction reducing friction useful friction the third law and physics of walls Newton's third law and helicopters	8 10 12 13 23 24 25 29 95	investigate Newton's first law of motion investigate Newton's second law of motion investigate Newton's 3rd law of motion relate Newton's 3rd law of motion to car collisions Newton's second law of motion investigate effect of friction apply Newton's second law of motion apply Newton's second law of motion Newton's 2nd law of motion and natural frequency

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				418 friction and damping 424 Newton's second law and oscillators	
SP1.e Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Measure and calculate the magnitude of gravitational forces.	39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 402 gravitational field	26 investigate projectile motion
SP1.f Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Measure and calculate two-dimensional motion (projectile and circular) by using component vectors.	112 resolving vectors	
SP1.g Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Measure and calculate centripetal force.	147 centripetal force 148 centripetal force	

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SP1.h Physics	Content	Students will analyze the relationships between force, mass, gravity, and the motion of objects.	Determine the conditions required to maintain a body in a state of static equilibrium.	31 net force explained 36 balanced and unbalanced forces 37 net force and second law calculating 116 when net force is zero 127 rotational equilibrium	11 investigate net force 22 when net force is zero
SP2.a Physics	Content	Students will evaluate the significance of energy in understanding the structure of matter and the universe.	Relate the energy produced through fission and fusion by stars as a driving force in the universe.	269 fusion reactions 270 fission reactions	
SP2.b Physics	Content	Students will evaluate the significance of energy in understanding the structure of matter and the universe.	Explain how the instability of radioactive isotopes results in spontaneous nuclear reactions.	221 weak force explained 222 radioactive decay 267 nuclear reactions explained 268 nuclear reactions and energy 270 radioactive materials	

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SP3.a Physics	Content	Students will evaluate the forms and transformations of energy.	Analyze, evaluate, and apply the principle of conservation of energy and measure the components of work-energy theorem by <ul style="list-style-type: none"> • describing total energy in a closed system. • identifying different types of potential energy. 	9 basic forms of energy 10 conservation of energy 66 energy is stored work 67 calculating potential energy 67 potential energy explained 68 calculating kinetic energy 68 potential to kinetic energy conversions 68 kinetic energy explained 69 kinetic energy and stopping distance of a car 70 potential to kinetic energy conversions 70 law of conservation of energy 71 using energy conservation to solve problems 117 potential and kinetic energy in a spring 240 energy and systems 241 energy exists in many different forms 243 energy flow diagrams 249 energy flow diagram for mechanical systems	14 investigate exchange of energy in car and track system 15 calculate potential energy of car 15 apply law of energy conservation 19 investigate concept of energy as stored work 24 calculate kinetic energy of sled 42 model how atoms exchange energy 45 describe energy changes 46 investigate energy flow in a system 47 calculate energy 47 identify forms of energy in an experimental system 47 draw an energy flow diagram 57 draw energy flow diagram of the circuit

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
				249 mechanical systems and energy 251 energy flow in natural systems	
SP3.b Physics	Content	Students will evaluate the forms and transformations of energy.	Explain the relationship between matter and energy.	167 what are elements 169 compare and contrast elements and compounds and molecules and mixtures 169 definition of compound 174 heat energy and molecular motion 176 understanding the difference between heat and temperature 177 heat and work 220 protons and neutrons and electrons 280 meaning of Einstein's formula 343 electrons and picture tubes 347 electron motion and current	30 investigate difference between temperature and heat 39 atomic structure

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP3.c Physics	Content	Students will evaluate the forms and transformations of energy.	Measure and calculate the vector nature of momentum.	61 momentum is calculated with velocity – not speed 63 law of conservation of momentum 64 using momentum conservation to solve problems 74 momentum and collisions 77 momentum and car safety	13 apply the law of conservation of momentum
SP3.d Physics	Content	Students will evaluate the forms and transformations of energy.	Compare and contrast elastic and inelastic collisions.	73 elastic and inelastic collisions 74 momentum conservation in collisions 75 forces in collisions	13 investigate collisions with the energy car
SP3.e Physics	Content	Students will evaluate the forms and transformations of energy.	Demonstrate the factors required to produce a change in momentum.	61 momentum is calculated with velocity – not speed 62 understanding impulse 76 impulse and practical problem solving	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP3.f Physics	Content	Students will evaluate the forms and transformations of energy.	Analyze the relationship between temperature, internal energy, and work done in a physical system.	86 calculating work 88 calculating work 172 kinetic theory and temperature 176 understanding the difference between heat and temperature 176 flow of thermal energy is heat 177 heat and work 185 heat transfer is everywhere	30 investigate difference between temperature and heat
SP3.g Physics	Content	Students will evaluate the forms and transformations of energy.	Analyze and measure power.	89 calculating power 90 maximum power output of a person 244 power explained 245 three ways to look at power 250 power in human technology 252 power in natural systems 254 wave power 254 tidal power	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page		Volume Two Investigation Manual Page
SP4.a Physics	Content	Students will analyze the properties and applications of waves.	Explain the processes that results in the production and energy transfer of electromagnetic waves.	434	waves transmit energy	
				435	waves and technology	
				447	waves and energy	

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page		
SP4.b Physics	Content	Students will analyze the properties and applications of waves.	Experimentally determine the behavior of waves in various media in terms of reflection, refraction, and diffraction of waves.	442	reflected waves	113	construct ray diagrams
				442	refracted waves	113	investigate law of reflection
				443	diffraction explained	113	use a mirror to observe reflected light
				482	refraction of light	114	construct ray diagrams
				482	reflection of light	114	use results to derive law of reflection
				499	converging and diverging lenses	114	use a prism to investigate light rays
				499	mirrors reflect light	119	investigate lenses and magnification
				501	reflection explained	120	using a mirror to reflect light
				502	drawing a ray diagram	120	investigate reflection of light
				502	the law of reflection	121	investigate refraction of light
				503	understanding refraction	121	use a lens to refract light
				503	index of refraction	122	investigate diffraction of light
				504	angles of incidence and refraction		
				508	ray diagram of an image in a mirror		
				510	ray diagram for a converging lens		
				511	the image formed by a lens		
				528	diffraction and light		
530	diffraction gratings and spectrometers						

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP4.c Physics	Content	Students will analyze the properties and applications of waves.	Explain the relationship between the phenomena of interference and the principle of superposition.	421 circular motion and phase 422 harmonic motion that is out of phase 444 the superposition principle 445 destructive interference 445 constructive interference 454 superposition principle and complex sound 469 frequency of sound and beats 529 interference of light waves	106 investigate interference and beats
SP4.d Physics	Content	Students will analyze the properties and applications of waves.	Demonstrate the transfer of energy through different mediums by mechanical waves.	435 how to recognize waves 436 longitudinal waves 436 transverse waves 440 standing waves on a vibrating string 459 sound waves and different media	98 study waves on a string 99 explore transverse waves 100 study water waves 124 relating transverse waves on a spring to light waves

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP4.e Physics	Content	Students will analyze the properties and applications of waves.	Determine the location and nature of images formed by the reflection or refraction of light.	498 optical systems 499 mirrors reflect light 502 drawing a ray diagram 507 objects and images 508 ray diagram of an image in a mirror 509 focal point and focal length 510 ray diagram for a converging lens 511 the image formed by a lens 514 understanding optical systems	113 use a mirror to observe reflected light 113 construct ray diagrams 114 use a prism to investigate light rays 114 construct ray diagrams 117 find focal lengths of lenses 117 investigate images formed by lenses 119 investigate lenses and magnification 120 using a mirror to reflect light 121 use a lens to refract light
SP5.a Physics	Content	Students will evaluate relationships between electrical and magnetic forces.	Describe the transformation of mechanical energy into electrical energy and the transmission of electrical energy.	255 energy in the ocean 330 alternating current 330 direct current 364 electromagnets 365 building an electromagnet 387 electromagnetic induction explained 389 how a generator works	85 investigate electromagnetic induction 87 investigate how generators work 157 research electricity generation methods

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP5.b Physics	Content	Students will evaluate relationships between electrical and magnetic forces.	Determine the relationship among potential difference, current, and resistance in a direct current circuit.	298 electric current 302 current in simple circuits 303 understanding voltage 305 measuring current with a multimeter 308 Ohm's law 319 current in a series circuit 320 voltage in a series circuit 321 Ohm's law and voltage drops 323 current in a parallel circuit 324 voltage in a parallel circuit 346 charge and current 349 voltage and charge 351 voltage and capacitors	58 measure voltage 59 measure current 60 measure voltage 62 investigate Ohm's law 63 use Ohm's law 65 measure the voltage 66 current in a series circuit 67 Ohm's law and short circuits 74 investigate the flow of electric charge 75 work with Ohm's law

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP5.c Physics	Content	Students will evaluate relationships between electrical and magnetic forces.	Determine equivalent resistances in series and parallel circuits.	299 examples of electric circuits in nature 299 electric circuits 301 battery circuits 318 series circuits 323 parallel circuits 325 comparing series and parallel circuits 326 parallel circuits in homes	57 build circuits 60 a circuit with a dimmer switch 65 investigate series circuits 65 build a circuit with three bulbs and a switch 66 investigate series circuits 68 compare series and parallel circuits 68 investigate parallel circuits 69 construct a simple circuit
SP5.d Physics	Content	Students will evaluate relationships between electrical and magnetic forces.	Determine the relationship between moving electric charges and magnetic fields.	361 using magnetic forces 364 right-hand rule 380 effect of current on a compass 382 using coils to concentrate a magnetic field 388 Faraday's law of induction 404 the electric field 522 electromagnetic waves	82 investigate how a steel pin affects magnetic force created by a coil 89 understand and investigate electric and gravitational fields

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Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP6.a Physics	Content	The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.	Explain matter as a particle and as a wave.	481 speed of light 486 photons 533 photon theory of light	
SP6.b Physics	Content	The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.	Describe the Uncertainty Principle.	232 understanding the uncertainty principle	
SP6.c Physics	Content	The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.	Explain the differences in time, space, and mass measurements by two observers when one is in a frame of reference moving at constant velocity parallel to one of the coordinate axes of the other observer's frame of reference...	284 theory of special relativity	53 explore the concept of relativity 55 a thought experiment on Einstein's theories

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Student Text and Investigation Manual

Standard #: Course	Co-Requisite	Standard	Learning Goal	Volume One Student Text Page	Volume Two Investigation Manual Page
SP6.d Physics	Content	The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.	Describe the gravitational field surrounding a large mass and its effect on a ray of light.	280 meaning of Einstein's formula	