

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.1.A.01 Secondary	1. Students understand the nature of mathematics and science	A. Students use scientific inquiry to provide insight into and comprehension of the world around them.	Make accurate observations using appropriate tools and units of measure.	18	measuring distance	1	estimating length
				18	measurements of distance in units of length	2	practice length measurement
				19	description of length measured in English and metric systems	2	measuring a pencil
				19	scientists use metric units	3	convert from inches to meters
				20	how to convert units of measurement	4	using a timer
				20	understanding metric rulers	4	measuring time
				21	conversions between area and volume units	5	using photogates
				21	calculating volume of simple shapes	6	collecting data with precision
				22	time intervals	6	accuracy and resolution and printing
				23	reading a digital timer	6	precision in measurement
				23	units for measuring time	7	using devices to measure mass
				24	time intervals in physics	7	estimating mass
				25	accuracy and precision of measurements	9	using timer and photogates
				25	accuracy and precision of measurements	9	make distance measurement
				27	measuring mass in kg and grams	11	using timer and photogates
				33	commonly used units for measuring mass	14	using a timer and photogates

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				34	converting length units between systems	17	using a timer and photogates
				82	units of force are pounds and newtons	18	measure the length
				83	understanding units for using Newton's second law	18	use a ruler
				91	the force platform	18	collect time data with precision
				244	frequency is measured in hertz	18	use a timer and photogates
				382	unit of electric current is the ampere or amp (A)	21	use a timer and photogates
				383	voltage is measured in volts (V)	23	measure the distance
				383	using a multimeter to measure voltage	23	use a timer and photogates
				383	using a multimeter to measure voltage	26	find length in centimeters
				385	measuring current with an ammeter or multimeter	26	use a timer and photogates
				387	measuring current with an ammeter or multimeter	29	find mass
				387	using a multimeter to measure resistance	29	use a meter stick
				387	electrical resistance is measured in ohms	29	use a spring scale
				408	measuring power in watts	29	measure the force
				409	units of watts and horsepower used in electrical circuits	34	use a spring scale
				409	units of watts and horsepower used in electrical circuits	34	measure the force
				410	electric companies charge for kilowatt-hours used	34	measure the mass
				410	electric companies charge for kilowatt-hours used	36	use a meter stick
				410	electric companies charge for kilowatt-hours used	36	measure the new position
				410	electric companies charge for kilowatt-hours used	36	measure the mass

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				421	one ampere is the flow of one coulomb per second	39	using a compass
				504	Celsius and Fahrenheit thermometers	42	use a timer and photogates
				505	how thermometers work	43	measure the distance
				513	joules and calories and Btus	43	measure and record the distance
						44	use a spring scale
						47	use a timer and photogate
						50	use a timer and photogate
						58	use a timer and photogate
						60	use a spring scale
						60	measure input and output forces
						62	measure string length
						65	measure vertical distance
						65	use a timer and photogate
						67	use a timer and photogate
						67	measure vertical distance
						68	convert grams to kilograms
						70	measure and mark height
						75	use a timer and photogates
						78	measure mass of ball
						78	make the string 70 cm long

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						78	use meter stick to measure height
						82	use a timer and photogate
						82	measure the length of the string
						87	use photogate and timer to measure the period
						89	use a spring scale to measure tension of string
						90	use a timer and photogates
						93	use the timer to measure frequency
						93	measure frequency
						96	measure frequency
						131	measure current in a circuit
						131	use a multimeter to measure current
						132	measure voltage in a circuit
						132	use a multimeter to measure voltage
						135	use a multimeter to measure current and voltage
						137	measure voltage and current in series circuits
						139	use a multimeter

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						140	use the multimeter
						153	making measurements with precision
						153	make measurement with precision
						157	reading a compass
						163	measure direct current
						163	use a multimeter
						164	use a multimeter to measure voltage
						164	measure voltage of battery pack
						165	measure voltage
						165	use a multimeter
						166	use a photogate and timer
						169	use a multimeter
						169	measure current and voltage
						171	measure current and voltage
						171	use a multimeter
						176	use a thermometer
						178	measure 100 grams of water
						178	measure the temperature
						180	measure the temperature

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						192	use a digital balance
						192	find the mass of the bottle
						202	find the mass
						202	find the mass to the nearest tenth of a gram
S.1.A.02 Secondary	1. Students understand the nature of mathematics and science	A. Students use scientific inquiry to provide insight into and comprehension of the world around them.	2. Demonstrate the ability to use scientific inquiry and the technological method with short-term and long-term investigations, recognizing that there is more than one way to solve a problem. Demonstrate knowledge of when to try different strategies.	7	revising explanations through observation	21	conduct the experiment
				8	refining theories based on observations	28	set up the ultimate pulley
				242	finding a basic cycle of harmonic motion	43	perform experiment
				293	demonstrating the Doppler effect	65	investigate motion on a roller coaster
				456	an experiment with a wire and compass	65	studying motion of ball on loop track
				463	building an electromagnet with wire and a nail	67	set up the straight track
				467	experiment demonstrating electromagnetic induction	67	investigate motion on a roller coaster
						85	select appropriate technology to make measurements
						85	design and test a way to increase natural frequency
						129	choose circuit parts to light a bulb
						202	conduct your experiment

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.1.B.01 Secondary	1. Students understand the nature of mathematics and science	B. Students use mathematical inquiry to develop conjectures and to prove or disprove them within a mathematical system.	1. Differentiate between different mathematical systems and recognize that rules which hold in one system may not hold in others.	5	identify laws or relationships that apply to the problem	2	practice length measurement
				11	Ptolemy model vs. Copernicus model of the solar system	3	convert from inches to meters
				18	measurements of distance in units of length	9	make distance measurement
				19	scientists use metric units	13	compare prediction to measurement
				19	description of length measured in English and metric systems	16	what do the results tell you?
				20	how to convert units of measurement	18	are the accelerations different?
				21	conversions between area and volume units	18	measure the length
				34	converting length units between systems	19	does the ball accelerate?
				39	identify relationships	22	uniform acceleration model
				40	making a good model	22	how do you measured positions compare to model?
				44	using a graphical model to make a prediction and checking the model's accuracy	22	compare calculation with graph estimate
				60	creating the acceleration formula from experiments	23	measure the distance
				66	developing the formulas for a model of motion with constant acceleration	24	create an algebraic model
						26	find length in centimeters
						28	solve second law equation for string tension
						29	does experiment agree with prediction?

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				67	solving motion problems with acceleration	32	develop a model that predicts acceleration
				120	representing vectors in Cartesian and polar coordinates	36	measure the new position
						40	using polar coordinates
				125	representing the velocity vector in polar and Cartesian coordinates	41	plotting position with cartesian coordinates
				126	representing the velocity vector in polar and Cartesian coordinates	43	how does the measurement compare to your prediction?
						43	create algebraic model
				132	representing the force vector in Cartesian and polar coordinates	43	what would happen if...?
						49	write a formula
				134	choosing coordinates for an inclined plane	58	explain why the angular acceleration is different
				141	explain vectors in Cartesian and polar coordinates	62	measure string length
						65	measure vertical distance
				282	write a formula relating velocity of wave to period and wavelength	70	measure and mark height
						76	compare predicted mass to actual mass
				297	frequency spectrum	78	make the string 70 cm long
				306	explain why hearing can be damaged by loud sounds	80	explain your observations
						87	explain how force applied causes the response
				312	light intensity follows an inverse square law	90	explain why higher tension makes waves move faster
				406	using a systematic approach to solving circuit problems		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						92	explain how wind might cause big waves in water
						94	give an equation that describes your observations
						109	explain how the colored filters work
						114	are there differences between your prediction and measurement?
						132	what conclusions can you draw?
						133	analyze data and explain a rule
						189	Bernoulli's equation
S.1.B.02 Secondary	1. Students understand the nature of mathematics and science	B. Students use mathematical inquiry to develop conjectures and to prove or disprove them within a mathematical system.	2. Construct formal mathematical arguments to prove or disprove conjectures.	60	creating the acceleration formula from experiments	22	uniform acceleration model
				66	developing the formulas for a model of motion with constant acceleration	24	create an algebraic model
				282	write a formula relating velocity of wave to period and wavelength	28	solve second law equation for string tension
				312	light intensity follows an inverse square law	32	develop a model that predicts acceleration
						43	create algebraic model
						49	write a formula
						94	give an equation that describes your observations
						189	Bernoulli's equation

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.1.C.01 Secondary	1. Students understand the nature of mathematics and science	C. Students develop models to understand the world around them.	1. Make predictions using statistics, probability and functions.	412	average voltage and current of AC power	25 58 67 71	find the average time find average of three trials calculate average of three times calculate average work and power
S.1.C.02 Secondary	1. Students understand the nature of mathematics and science	C. Students develop models to understand the world around them.	2. Form logical arguments to justify explanations.	7 8 10 71	revising explanations through observation refining theories based on observations the usefulness of phlogiston theory despite being incorrect parachutes and air resistance	204	build models of Na and Cl and use them to explain bonding

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.1.C.03 Secondary	1. Students understand the nature of mathematics and science	C. Students develop models to understand the world around them.	3. Represent and analyze relationships using tables, verbal rules, equations and graphs.		data tables and graphs can be created on computer or graphing calculator	13	create a graph
				24	making graphs of experimental results over time	15	record data in a table
				42	writing procedures in a lab notebook helps make sure your results are repeatable	16	describe the graph
				43	graphs are a way of representing data	16	create a graph
				43	constructing a graph	17	use a data table
				43	constructing a graph	18	record data
				44	using a graph to make predictions	21	record results in table
				44	graphical models	22	create graphs
				45	recognizing patterns using graphs	27	record position and time data
				45	recognizing relationships between variables from graphs	29	record mass and force
				54	constructing a graph	37	make a graph
				54	understanding patterns in relationships between variables	38	make a graph
				55	create a graph from a data table	43	sketch four graphs
						43	create four graphs
						56	create a graph
						66	record data in table
						66	create a graph of speed vs. position
						70	record data in table
						82	make three different graphs
						82	create data table for self-designed experiment
						82	record your data in table

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				56	indicate relationships between variables in graphs	87	sketch a graph
				142	finding x and y components of velocity for model rocket	122	communicate your findings
				246	understanding graphs of harmonic motion	122	present your findings
				246	understanding graphs of harmonic motion	135	graph voltage vs. current
				260	analyze graph of an oscillator	136	graph voltage vs. current
				290	the process of digital sound reproduction	151	make a graph of voltage vs. time
				304	comparison of wave forms from guitar sounds	160	create a graph
				307	decibel level vs. frequency graph for human hearing	167	make a graph of voltage vs. number of magnets
				411	the waveform of AC electricity	169	make a current vs. voltage graph for the diode
				427	diagramming electric fields using field lines		
				443	diagramming magnetic fields using magnetic field lines		
				479	current vs.voltage graph for a transistor		

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S.1.C.04 Secondary	1. Students understand the nature of mathematics and science	C. Students develop models to understand the world around them.	4. Translate among tabular, symbolic and graphical representations of functions.		data tables and graphs can be created on computer or graphing calculator		
				43	graphs are a way of representing data		
				45	recognizing patterns using graphs		
				54	understanding patterns in relationships between variables		
				56	indicate relationships between variables in graphs		
				246	understanding graphs of harmonic motion		
				304	comparison of wave forms from guitar sounds		
				307	decibel level vs. frequency graph for human hearing		
				427	diagramming electric fields using field lines		
				443	diagramming magnetic fields using magnetic field lines		
				479	current vs.voltage graph for a transistor		

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S.1.C.05 Secondary	1. Students understand the nature of mathematics and science	C. Students develop models to understand the world around them.	5. Demonstrate an understanding that while mathematical statements may be true, it does not mean that models based on these statements are always valid; models must be tested against reality just as scientific theories are tested.	11	Ptolemy model vs. Copernicus model of the solar system	13	create a graph
				40	making a good model	13	compare prediction to measurement
				43	constructing a graph	16	describe the graph
				44	using a graphical model to make a prediction and checking the model's accuracy	16	create a graph
				44	graphical models	22	create graphs
				54	constructing a graph	22	compare calculation with graph estimate
				55	create a graph from a data table	22	how do you measured positions compare to model?
				290	the process of digital sound reproduction	29	does experiment agree with prediction?
				297	frequency spectrum	37	make a graph
				411	the waveform of AC electricity	38	make a graph
						43	how does the measurement compare to your prediction?
						43	sketch four graphs
						56	create a graph
						66	create a graph of speed vs. position
						76	compare predicted mass to actual mass
						82	make three different graphs
						87	sketch a graph

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						114 are there differences between your prediction and measurement? 135 graph voltage vs. current 136 graph voltage vs. current 151 make a graph of voltage vs. time 160 create a graph 167 make a graph of voltage vs. number of magnets 169 make a current vs. voltage graph for the diode	
S.2.A.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	A. Students use clear and accurate communication in sharing their knowledge.	1. Analyze research or other literature for accuracy in the design and findings of experiments	136 188 367 369 375	determining formula for acceleration on a ramp perpetual motion machines speed of light did not behave as expected for Michelson and Morley proof of time dilation explain Thomas Young's demonstration of the wave nature of light	12 33 50 66 111	do your results agree with hypothesis? does your experiment confirm your hypothesis? does your experiment provide confirmation? does this agree with your hypothesis? how does what you observed support the quantum theory?

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.2.A.02 Secondary	2. Students Communicate Effectively in Mathematics and Science	A. Students use clear and accurate communication in sharing their knowledge.	2. Use families of functions, displayed in graphical, tabular and symbolic form, to communicate and support findings and ideas.		data tables and graphs can be created on computer or graphing calculator	13	create a graph
				43	graphs are a way of representing data	15	record data in a table
				43	constructing a graph	16	create a graph
				44	graphical models	16	describe the graph
				45	recognizing patterns using graphs	17	use a data table
				54	constructing a graph	18	record data
				54	understanding patterns in relationships between variables	21	record results in table
				55	create a graph from a data table	22	create graphs
				56	indicate relationships between variables in graphs	27	record position and time data
				142	finding x and y components of velocity for model rocket	29	record mass and force
				246	understanding graphs of harmonic motion	37	make a graph
				290	the process of digital sound reproduction	38	make a graph
				304	comparison of wave forms from guitar sounds	43	sketch four graphs
						56	create a graph
						66	record data in table
						66	create a graph of speed vs. position
						70	record data in table
						82	create data table for self-designed experiment
						82	make three different graphs
						82	record your data in table
						87	sketch a graph

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				307	decibel level vs. frequency graph for human hearing	135	graph voltage vs. current
				411	the waveform of AC electricity	136	graph voltage vs. current
				427	diagramming electric fields using field lines	151	make a graph of voltage vs. time
				443	diagramming magnetic fields using magnetic field lines	160	create a graph
				479	current vs.voltage graph for a transistor	167	make a graph of voltage vs. number of magnets
						169	make a current vs. voltage graph for the diode

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S.2.B.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	B. Students construct knowledge through reflection, evaluation and refocusing.	1. Use journals and self-assessment to describe and analyze mathematical, scientific, and technological experiences and to reflect on problem-solving processes.	2	analysis of a problem	43	write a procedure
				5	identify laws or relationships that apply to the problem	175	display information you found for your element
				5	determine what you are asked for	201	develop a procedure
				5	identify what you know	202	keep detailed notes as you work
				39	identify the problem		
				39	identify relationships		
				39	identify what information you have		
				42	writing procedures in a lab notebook helps make sure your results are repeatable		
				42	writing lab procedures		
				67	solving motion problems with acceleration		
				67	solving motion problems with acceleration		
				67	solving motion problems with acceleration		
				89	identifying which force is acting on which object		
				406	using a systematic approach to solving circuit problems		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				406	using a systematic approach to solving circuit problems		
				406	using a systematic approach to solving circuit problems		
				406	using a systematic approach to solving circuit problems		
S.2.B.02 Secondary	2. Students Communicate Effectively in Mathematics and Science	B. Students construct knowledge through reflection, evaluation and refocusing.	2. Refine and extend the use of self-assessment tools.	136	determining formula for acceleration on a ramp	12	do your results agree with hypothesis?
				188	perpetual motion machines	33	does your experiment confirm your hypothesis?
				367	speed of light did not behave as expected for Michelson and Morley	50	does your experiment provide confirmation?
				369	proof of time dilation	66	does this agree with your hypothesis?
				375	explain Thomas Young's demonstration of the wave nature of light	111	how does what you observed support the quantum theory?

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.2.C.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	C. Students use models to communicate in mathematics and science.	1. Make and use appropriate mathematical and scientific symbols, pictures, diagrams, scale drawings, and models to represent and simplify real life situations and to solve problems.	24	making graphs of experimental results over time	13	create a graph
				43	constructing a graph	16	describe the graph
				43	constructing a graph	16	create a graph
				44	using a graph to make predictions	22	create graphs
				44	graphical models	22	uniform acceleration model
				45	recognizing relationships between variables from graphs	24	create an algebraic model
				54	constructing a graph	28	interpret setup diagram
				55	create a graph from a data table	28	solve second law equation for string tension
				60	creating the acceleration formula from experiments	32	develop a model that predicts acceleration
				66	developing the formulas for a model of motion with constant acceleration	37	make a graph
				107	drawing free-body diagrams	38	make a graph
				116	draw a free-body diagram	43	create algebraic model
				125	drawing the velocity vector	43	create four graphs
				212	making an energy flow diagram	43	sketch four graphs
				246	understanding graphs of harmonic motion	49	write a formula
		56	create a graph				
		66	create a graph of speed vs. position				
		82	make three different graphs				
		85	draw a sketch of your system				
		87	sketch a graph				

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				282	write a formula relating velocity of wave to period and wavelength	92	sketch the wave fronts
				290	the process of digital sound reproduction	94	give an equation that describes your observations
				312	light intensity follows an inverse square law	135	graph voltage vs. current
				333	drawing a ray diagram	136	graph voltage vs. current
				342	drawing ray diagrams of lenses	151	make a graph of voltage vs. time
				380	circuit diagrams and electrical symbols	160	create a graph
				411	the waveform of AC electricity	167	make a graph of voltage vs. number of magnets
				427	drawing the electric field using field lines	169	make a current vs. voltage graph for the diode
				443	diagramming magnetic fields using magnetic field lines	189	Bernoulli's equation

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S.2.C.02 Secondary	2. Students Communicate Effectively in Mathematics and Science	C. Students use models to communicate in mathematics and science.	2. Employ graphs, tables, and maps in making arguments and conclusions.	43	constructing a graph	13	create a graph
				43	graphs are a way of representing data	15	record data in a table
				44	graphical models	16	create a graph
				45	recognizing patterns using graphs	16	describe the graph
				54	constructing a graph	17	use a data table
				54	understanding patterns in relationships between variables	18	record data
				55	create a graph from a data table	21	record results in table
				56	indicate relationships between variables in graphs	22	create graphs
				142	finding x and y components of velocity for model rocket	27	record position and time data
				246	understanding graphs of harmonic motion	29	record mass and force
				290	the process of digital sound reproduction	37	make a graph
				304	comparison of wave forms from guitar sounds	38	make a graph
				307	decibel level vs. frequency graph for human hearing	43	sketch four graphs
				411	the waveform of AC electricity	56	create a graph

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				427	diagramming electric fields using field lines	135	graph voltage vs. current
				443	diagramming magnetic fields using magnetic field lines	136	graph voltage vs. current
						151	make a graph of voltage vs. time
				479	current vs.voltage graph for a transistor	160	create a graph
						167	make a graph of voltage vs. number of magnets
						169	make a current vs. voltage graph for the diode

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S.2.C.03 Secondary	2. Students Communicate Effectively in Mathematics and Science	C. Students use models to communicate in mathematics and science.	3. Critique models, stating how they do and do not effectively represent the real phenomenon.	7	developing models to explain observations	13	compare prediction to measurement
				11	Ptolemy model vs. Copernicus model of the solar system	22	how do you measured positions compare to model?
				40	making a good model	22	compare calculation with graph estimate
				40	creating useful models	22	model for uniform accelerated motion
				44	using a graphical model to make a prediction and checking the model's accuracy	29	does experiment agree with prediction?
				101	a model for friction	43	how does the measurement compare to your prediction?
				102	a model for static friction		
				297	frequency spectrum	76	compare predicted mass to actual mass
				330	optics and optical instruments	114	are there differences between your prediction and measurement?
				492	the binary number system and its use in computers		

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S.2.D.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	D. Students demonstrate competency in using multiple media to communicate in mathematics and science.	1. Evaluate the communication capabilities of new kinds of media (e.g., cameras with computer disks instead of film).	262	waves are all around us		
				277	standing waves are used to store energy		
				281	use of microwaves in microwave ovens		
				290	recording sound		
				297	recording complex wave forms		
				302	synthesized instruments		
				304	modifying sound electronically in electric guitars		
				310	light is a form of energy		
				312	the intensity of light		
				313	information in sound is carried by light		
				313	light carries information		
				314	the speed of light		
				328	how is light used for communication?		
				336	how fiber optics work		
				353	explain fiber optic cables		
				356	light can be described in terms of waves		
				357	frequency and wavelength of light		

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				358	speed of light is frequency multiplied by length		
				359	descriptions of radio waves and microwaves and infrared rays		
				360	x-rays and gamma rays		
				373	wave fronts of light		
				376	fiber optic cable calculation		
				405	use of voltage dividers in sound electronics		
				452	MRI uses radio waves		
				484	stereo uses transistor circuit		
				488	analog vs. digital signals in sound reproduction		
S.2.D.02 Secondary	2. Students Communicate Effectively in Mathematics and Science	D. Students demonstrate competency in using multiple media to communicate in mathematics and science.	2. Use computers to organize data, generate models, and do research for problem solving.		data tables and graphs can be created on computer or graphing calculator		

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.2.E.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	E. Students critically analyze information from a variety of sources.	1. Restate, create, and use definitions in mathematics to express understanding, classify figures, and determine the truth of a proposition or argument.	60	creating the acceleration formula from experiments	22	uniform acceleration model
				66	developing the formulas for a model of motion with constant acceleration	24	create an algebraic model
				282	write a formula relating velocity of wave to period and wavelength	25	find the average time
						28	solve second law equation for string tension
				312	light intensity follows an inverse square law	28	solve second law equation for string tension
						32	develop a model that predicts acceleration
				412	average voltage and current of AC power	32	develop a model that predicts acceleration
						43	create algebraic model
						49	write a formula
						58	find average of three trials
						67	calculate average of three times
						71	calculate average work and power
						94	give an equation that describes your observations
						189	Bernoulli's equation
S.2.E.03 Secondary	2. Students Communicate Effectively in Mathematics and Science	E. Students critically analyze information from a variety of sources.	3. Engage in a debate on a scientific issue, where both points of view are based on the same information.	42	writing procedures in a lab notebook helps make sure your results are repeatable	122	communicate your findings
						122	present your findings
						175	display information you found for your element
						202	keep detailed notes as you work

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.2.F.01 Secondary	2. Students Communicate Effectively in Mathematics and Science	F. Individually and collaboratively, students use effective communication techniques.	1. Identify tasks, formulate groups and assign roles to accomplish the tasks.	242	finding a basic cycle of harmonic motion	43	perform experiment
				432	making a simple capacitor	65	investigate motion on a roller coaster
				456	an experiment with a wire and compass	67	investigate motion on a roller coaster
				463	building an electromagnet with wire and a nail	82	design an experiment
				467	experiment demonstrating electromagnetic induction	201	design a procedure to separate a mixture
S.3.A.01 Secondary	3. Students Reason Effectively in Mathematics and Science	A. Students understand and demonstrate that ideas are more powerful if they can be justified.	1. Distinguish between different forms of logic.	136	determining formula for acceleration on a ramp	12	do your results agree with hypothesis?
				188	perpetual motion machines	33	does your experiment confirm your hypothesis?
				367	speed of light did not behave as expected for Michelson and Morley	50	does your experiment provide confirmation?
				369	proof of time dilation	66	does this agree with your hypothesis?
				375	explain Thomas Young's demonstration of the wave nature of light	111	how does what you observed support the quantum theory?

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.3.B.01 Middle	3. Students Reason Effectively in Mathematics and Science	B. Students use different methods of thought to justify ideas.	1. Judge the accuracy of alternative explanations by identifying the evidence necessary to support them.	4	inquiry through observation	12	was this experiment better or worse than the first?
				7	creating explanations through observation	43	perform experiment
				8	forming hypotheses and testing with experiments	43	test your prediction
				10	putting forth ideas and then testing them	65	investigate motion on a roller coaster
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	65	where does the marble move the fastest?
				44	checking a graphical model's accuracy	67	investigate motion on a roller coaster
				103	evaluating perpetual motion claims	97	reliability of a double-blind test
				242	finding a basic cycle of harmonic motion	97	did the method give an accurate result?
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	111	do your observations support this hypothesis?
				423	charge by friction	147	how did A and B tapes acquire different charge?
				456	an experiment with a wire and compass		
				463	building an electromagnet with wire and a nail		
				467	experiment demonstrating electromagnetic induction		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.3.B.02 Secondary	3. Students Reason Effectively in Mathematics and Science	B. Students use different methods of thought to justify ideas.	2. Analyze situations where more than one logical conclusion can be drawn from the data presented.	11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	12	was this experiment better or worse than the first?
				44	checking a graphical model's accuracy	97	reliability of a double-blind test
				103	evaluating perpetual motion claims	97	did the method give an accurate result?

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Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.3.B.03 Secondary	3. Students Reason Effectively in Mathematics and Science	B. Students use different methods of thought to justify ideas.	3. Develop generalizations based on observations.	4	inquiry through observation	11	recognizing and controlling variables
				7	revising explanations through observation	12	was this experiment better or worse than the first?
				7	creating explanations through observation	43	test your prediction
				8	forming hypotheses and testing with experiments	65	where does the marble move the fastest?
				8	refining theories based on observations	82	determine which variable has the greatest effect
				10	the usefulness of phlogiston theory despite being incorrect	82	dependent and independent variables
				10	putting forth ideas and then testing them	97	reliability of a double-blind test
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	97	did the method give an accurate result?
						109	record observations
						110	examine the effects of glow-in-the-dark material
				40	defining variables	111	do your observations support this hypothesis?
				42	control and experimental variables	147	how did A and B tapes acquire different charge?
				43	dependent and independent variables in graphs	166	variables that affect the performance of the generator
				44	checking a graphical model's accuracy	204	build models of Na and Cl and use them to explain bonding
				54	importance of changing one variable at a time in an experiment		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				71	parachutes and air resistance		
				103	evaluating perpetual motion claims		
				251	changing the natural frequency of a stretched rubber band		
				323	using glow-in-the-dark plastic to demonstrate photon energy levels		
				423	charge by friction		
S.3.B.04 Secondary	3. Students Reason Effectively in Mathematics and Science	B. Students use different methods of thought to justify ideas.	4. Determine when there is a need to revise studies to improve their validity through better sampling, controls, or data analysis techniques.	11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	12	was this experiment better or worse than the first?
				44	checking a graphical model's accuracy	21	plan the experiment
				103	evaluating perpetual motion claims	82	design an experiment
				432	making a simple capacitor	97	reliability of a double-blind test
						97	did the method give an accurate result?
						201	determine the equipment you will need
						201	design a procedure to separate a mixture

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.3.B.05 Secondary	3. Students Reason Effectively in Mathematics and Science	B. Students use different methods of thought to justify ideas.	5. Produce inductive and deductive arguments to support conjecture.	2	understanding natural laws	11	formulate a testable hypothesis
				3	using life experiences and common sense	12	cause and effect relationships
				3	connecting cause and effect through observation	33	formulate a testable hypothesis
				4	inquiry through observation	43	test your prediction
				7	creating explanations through observation	48	formulate a hypothesis
				8	formulating a hypothesis	65	form a hypothesis
				8	forming hypotheses and testing with experiments	65	where does the marble move the fastest?
				9	testing ideas against scientific evidence	79	write a hypothesis
				9	connecting cause and effect through analysis	82	plan three experiments to determine which variable affects the period of a pendulum
				10	putting forth ideas and then testing them	90	what effect does changing the tension have?
				10	the usefulness of phlogiston theory despite being incorrect	111	do your observations support this hypothesis?
				45	recognizing patterns and cause and effect relationships	147	how did A and B tapes acquire different charge?
				71	parachutes and air resistance	204	build models of Na and Cl and use them to explain bonding
				323	using glow-in-the-dark plastic to demonstrate photon energy levels		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				423	charge by friction		
S.3.C.01 Secondary	3. Students Reason Effectively in Mathematics and Science	C. Students recognize instances in which attitudes influence reasoning.	1. Explain why agreement among people does not make an argument valid.	11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	12	was this experiment better or worse than the first?
				44	checking a graphical model's accuracy	97	reliability of a double-blind test
				103	evaluating perpetual motion claims	97	did the method give an accurate result?

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.3.C.02 Secondary	3. Students Reason Effectively in Mathematics and Science	C. Students recognize instances in which attitudes influence reasoning.	2. Describe an example that demonstrates what people study and how they study can affect the theories they develop.	7	in science inquiry is used to uncover truth	147	Gilbert built the first electroscope
				13	medical and health professions use physics		
				16	the relation between physics and other fields of science		
				52	Dr. Harold Edgerton and strobe photography		
				91	biomechanics application		
				112	impact of technology		
				208	James Watt		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				311	Thomas Edison and the electric light		
				314	Einstein and the speed of light		
				316	Albert Einstein		
				361	Thomas Young		
				366	Albert Einstein's theory of special relativity		
				367	Albert A. Michelson and Edward R. Morley		
				400	Gustav Robert Kirchhoff		
				449	Earth's magnetism		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				498	search for answers in physics and chemistry		
				560	deep water submarine Alvin application		
				574	Niels Bohr		
				575	Johann Balmer		
				578	Wolfgang Pauli		
				580	Max Planck and Albert Einstein		
				592	connections between biology and chemistry and physics		
				630	Wolfgang Pauli		
				641	research on future of the universe		
				644	proof of Einstein's theory of general relativity		
				644	proof of Einstein's theory of general relativity		
				645	astronomers find black holes by what is around them		
				647	Paul Dirac		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.4.A.01 Secondary	4. Students Are Problem-Solvers in Mathematics and Science	A. Students demonstrate proficiency using a variety of problem-solving strategies.	1. Verify, evaluate, and use results in a purposeful way. This includes analyzing and interpreting data, making predictions based on observed patterns, testing solutions against the original problem conditions, and formulating additional questions.	2	understanding natural laws	11	formulate a testable hypothesis
				3	using life experiences and common sense	12	was this experiment better or worse than the first?
				3	connecting cause and effect through observation	12	cause and effect relationships
				4	inquiry through observation	13	is there a trend in measurements?
				7	creating theories based on observations	13	compare prediction to measurement
				7	creating explanations through observation	13	predict speed of ball
				7	revising explanations through observation	16	what do the results tell you?
				8	formulating a hypothesis	18	how would acceleration be different?
				8	forming hypotheses and testing with experiments	18	propose one way to increase acceleration
				8	refining theories based on observations	18	are the accelerations different?
				9	connecting cause and effect through analysis	19	does the ball accelerate?
				9	testing ideas against scientific evidence	22	compare calculation with graph estimate
				10	the usefulness of phlogiston theory despite being incorrect	22	how do you measured positions compare to model?
				10	putting forth ideas and then testing them	29	does experiment agree with prediction?

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	33	calculate the predicted speed
				11	Ptolemy model vs. Copernicus model of the solar system	33	formulate a testable hypothesis
				11	Ptolemy model vs. Copernicus model of the solar system	37	use your graph to make a prediction
				25	why accuracy and precision are important	38	use your graph to make a prediction
				40	making a good model	42	predict exact landing location
				43	graphs are a way of representing data	43	how does the measurement compare to your prediction?
				44	using a graphical model to make a prediction and checking the model's accuracy	43	test your prediction
				44	checking a graphical model's accuracy	43	what would happen if...?
				45	recognizing patterns using graphs	43	perform experiment
				45	recognizing patterns and cause and effect relationships	48	formulate a hypothesis
				45	recognizing patterns and cause and effect relationships	58	explain why the angular acceleration is different
				54	understanding patterns in relationships between variables	63	as mechanical advantage increases what happens to length of pulled string?
				56	indicate relationships between variables in graphs	65	investigate motion on a roller coaster
				56	indicate relationships between variables in graphs	65	form a hypothesis
				56	indicate relationships between variables in graphs	65	where does the marble move the fastest?
				71	parachutes and air resistance	65	predict where the ball moves fastest

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				103	evaluating perpetual motion claims	66	what does the graph tell you?
				242	finding a basic cycle of harmonic motion	67	investigate motion on a roller coaster
				246	understanding graphs of harmonic motion	76	compare predicted mass to actual mass
				297	frequency spectrum	79	write a hypothesis
				304	comparison of wave forms from guitar sounds	80	explain your observations
				306	explain why hearing can be damaged by loud sounds	82	plan three experiments to determine which variable affects the period of a pendulum
				307	decibel level vs. frequency graph for human hearing	82	analyze data
						82	design an experiment
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	87	explain how force applied causes the response
				423	charge by friction	90	what effect does changing the tension have?
				427	diagramming electric fields using field lines	90	explain why higher tension makes waves move faster
				432	making a simple capacitor		
				443	diagramming magnetic fields using magnetic field lines	92	explain how wind might cause big waves in water
				456	an experiment with a wire and compass	97	did the method give an accurate result?
				463	building an electromagnet with wire and a nail	97	reliability of a double-blind test

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				467	experiment demonstrating electromagnetic induction	109	explain how the colored filters work
				479	current vs.voltage graph for a transistor	111	do your observations support this hypothesis?
				498	since wood is created from other matter it must not be a fundamental substance	114	are there differences between your prediction and measurement?
						132	what conclusions can you draw?
						132	predict what the current will be
						133	analyze data and explain a rule
						133	did battery voltage change?
						147	how did A and B tapes acquire different charge?
						201	design a procedure to separate a mixture
						202	would you modify your procedure further?
						202	identify two sources of experimental error
						204	build models of Na and Cl and use them to explain bonding

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.4.A.02 Secondary	4. Students Are Problem-Solvers in Mathematics and Science	A. Students demonstrate proficiency using a variety of problem-solving strategies.	2. Demonstrate the ability to use scientific inquiry and the technological method with short term and long term investigations, recognizing that there is more than one way to solve a problem. Demonstrate knowledge of when to try different strategies.	2	analysis of a problem	43	follow the scientific method
				5	identify laws or relationships that apply to the problem	83	design and construct a pendulum
				39	identify relationships	85	create a system that oscillates
				67	solving motion problems with acceleration	163	design and test different electric motors
				67	solving motion problems with acceleration	163	propose solutions that will work for each disk
				113	test and evaluate the prototype structure design	163	apply steps of the design cycle to building different electric motors
				113	build and test a prototype structure out of toothpicks		
				113	conceptual design for a bridge	164	evaluate the performance of motor designs
				113	the engineering design cycle	167	suggest improvements you could make to the generator design
				389	electrical devices are designed to operate at a certain voltage	173	designing and building logic circuits
				406	using a systematic approach to solving circuit problems	191	build an air-speed tester
				406	using a systematic approach to solving circuit problems		
				543	evaluate three designs for a bridge		
				543	failure analysis in the design process		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.4.A.03 Secondary	4. Students Are Problem-Solvers in Mathematics and Science	A. Students demonstrate proficiency using a variety of problem-solving strategies.	3. Design and construct a device to perform a specific function, then redesign for improvement (e.g., performance, cost).	113	test and evaluate the prototype structure design	83	design and construct a pendulum
				113	build and test a prototype structure out of toothpicks	85	create a system that oscillates
				113	conceptual design for a bridge	163	design and test different electric motors
				389	electrical devices are designed to operate at a certain voltage	163	propose solutions that will work for each disk
				543	evaluate three designs for a bridge	164	evaluate the performance of motor designs
						167	suggest improvements you could make to the generator design
		191	build an air-speed tester				

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.5.A.02 Secondary	5. Students Understand their Roles in the Natural World	A. Students apply mathematics and science concepts to demonstrate an understanding that natural systems, including human systems, are cyclic and interconnected.	2. Model mathematically the effects of human actions or other variables on natural systems.	7 40 101 102 219 330 392 492 534	developing models to explain observations creating useful models a model for friction a model for static friction using energy efficient products optics and optical instruments hybrid cars combine advantages of gasoline fuel and electric power the binary number system and its use in computers energy-efficient building application	22	model for uniform accelerated motion
S.5.A.03 Secondary	5. Students Understand their Roles in the Natural World	A. Students apply mathematics and science concepts to demonstrate an understanding that natural systems, including human systems, are cyclic and interconnected.	3. Explain that even in some very simple systems it may not always be possible to predict accurately the result of changing some part of the system.	24 119 213 499	time scales in physics drawing displacement vector using a scale breaking down an energy flow system into processes scale and Brownian motion		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.5.A.04 Secondary	5. Students Understand their Roles in the Natural World	A. Students apply mathematics and science concepts to demonstrate an understanding that natural systems, including human systems, are cyclic and interconnected.	4. Describe the effects of human intervention in a matter cycle.	219	using energy efficient products		
				392	hybrid cars combine advantages of gasoline fuel and electric power		
				392	environmental impact of auto pollution		
				534	energy-efficient building application		
				604	balancing chemical equation of acid rain		
				607	impact of combustion reaction of gasoline		
				621	human technology contributes to radiation in environment		
				628	nuclear waste		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.A.01 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	A. Students understand that science and mathematics help to make sense of the world.	1. Examine the impact of political decisions on science and technology.	12	all technology is based on fundamental laws of physics		
				31	use of nanotechnology		
				51	analyzing motion with video and strobe photography		
				72	antilock brakes application		
				112	relationship between science and engineering and technology		
				112	impact of technology		
				172	bicycle physics application		
				196	hydroelectric power application		
				235	jet engines application		
				243	oscillators are used in communications and music and clocks		
				257	quartz crystals application		
				263	waves can carry information		
				280	microwave ovens application		
				325	the printing press		
				369	technological advances have allowed discovery of the expanding universe		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				372	holography application		
				392	hybrid gas/electric cars application		
				413	wiring application		
				429	electron beam accelerators		
				434	how television works application		
				451	MRI application		
				472	maglev train application		
				473	how magplanes levitate		
				492	computers and electronic addition of numbers application		
				516	refrigerator application		
				534	energy-efficient building application		
				560	deep water submarine Alvin application		
				585	laser application		
				615	smoke detectors		
				623	creation of CAT scans		
				631	nuclear power application		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.A.02 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	A. Students understand that science and mathematics help to make sense of the world.	2. Examine the historical relationships between prevailing cultural beliefs and breakthroughs in science, mathematics, and technology (e.g., the work of Darwin, Kepler, Copernicus).	52	Dr. Harold Edgerton and strobe photography		
				155	first artificial human-made Earth satellite was Sputnik		
				178	Great Pyramid of Giza and simple machines		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				269	wave motion and equilibrium		
				290	technological breakthrough of sound recording		
				310	past theories of light		
				325	history of printing		
				348	the usefulness of recorded images		
				349	the telescope		
				361	Young's double-slit experiment		
				368	Einstein's thinking revolutionized physics		
				447	discovering and using magnetism		
				501	search for elements and alchemy		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				561	the Alvin research submarine		
				575	discovery of helium		
				625	turning lead into gold		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.A.03 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	A. Students understand that science and mathematics help to make sense of the world.	3. Research the life of a scientist or mathematician and explore the cultural influences upon his or her work.	52	Dr. Harold Edgerton and strobe photography	147	Gilbert built the first electroscope
				208	James Watt		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				311	Thomas Edison and the electric light		
				314	Einstein and the speed of light		
				316	Albert Einstein		
				361	Thomas Young		
				366	Albert Einstein's theory of special relativity		
				367	Albert A. Michelson and Edward R. Morley		
				400	Gustav Robert Kirchhoff		
				456	Hans Christian Oersted		
				472	Dr. D. Bruce Montgomery		
				499	Democritus		
				499	Albert Einstein		
				574	Niels Bohr		
				575	Johann Balmer		
				578	Wolfgang Pauli		
				580	Max Planck and Albert Einstein		
				630	Wolfgang Pauli		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				644	proof of Einstein's theory of general relativity		
				647	Paul Dirac		
S.6.A.04 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	A. Students understand that science and mathematics help to make sense of the world.	4. Recognize that there are certain questions and concerns that mathematics and science cannot answer or even address.	440	scientists have never found single magnetic poles		
				568	understanding how gravity works inside atoms		
				583	the meaning of the uncertainty principle		
				637	areas of active research in physics		
				640	unresolved questions of history of universe		
				641	research on future of the universe		
S.6.B.01 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	B. Students can describe how the use of mathematics, science and technology has led to many changes in the world.	1. Describe how developments in transportation technology have affected patterns of human settlement and ecological systems in Maine.		featured in ancillary component		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.B.02 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	B. Students can describe how the use of mathematics, science and technology has led to many changes in the world.	2. Describe how knowledge of atomic physics has changed energy production, medical technology and international relationships.	570	use of radioactive isotopes in medicine	213	fusion and fission
				573	fusion		
				573	nuclear reactions		
				622	x-ray machines		
				623	CAT scans		
				625	nuclear reactions		
				627	fusion reactions		
				628	fission reactions		
				632	nuclear energy		
				635	differences between fission and fusion		

Correlation to Maine's Curriculum Framework for Science

Foundations of Physics

Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.B.04 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	B. Students can describe how the use of mathematics, science and technology has led to many changes in the world.	4. Research how technological developments have affected productivity, and the resulting social consequences (class conflict, working conditions, unemployment, longevity, wealth, leisure time).	12	engineers design practical devices for solving problems		
				31	use of nanotechnology		
				72	antilock brakes application		
				112	designing a bridge		
				112	impact of technology		
				138	use of robots		
				155	geostationary satellites		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		
				217	research into tidal power		
				228	seat belts and air bags		
				235	jet engines application		
				257	quartz crystals application		
				280	microwave ovens application		
				293	uses of Doppler radar		
				311	invention of electric light		
				325	the printing press		
				349	the telescope		
				378	importance of electricity		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				392	hybrid gas/electric cars application		
				413	wiring application		
				434	how television works application		
				451	MRI application		
				490	why computers are useful		
				534	energy-efficient building application		
				623	creation of CAT scans		
				631	nuclear power application		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.B.05 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	B. Students can describe how the use of mathematics, science and technology has led to many changes in the world.	5. Investigate the relationship between technology development and natural resource use (agriculture, forestry, mineral extraction), including concepts of sustainability, competing uses and preservation of natural areas.	196	environmental impacts of hydroelectric power	143	the cost of using electrical appliances
				217	advantages of tidal energy		
				219	using energy efficient products		
				392	hybrid cars combine advantages of gasoline fuel and electric power		
				534	energy-efficient building application		
				602	hydrogen as a fuel		
				607	refining petroleum produces gasoline and heating oil and asphalt		
				608	cracking used to produce high-octane gasoline		
				608	alternate fuels to gasoline		
				618	power released by radioactive decay		
				632	nuclear energy		
				634	comparison of fission and fusion		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.C.04 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	C. Students understand that mathematics and science have changed human understanding of the universe.	4. Explain how refinements in scientific and mathematical tools and techniques are enabling scientists and mathematicians to study phenomena and situations in ever-increasing detail.	13	x-ray and ultrasound technology are used in medicine	168	electronic devices are part of our daily lives
				31	nanotechnology application		
				73	use of control computers in cars		
				234	gyroscopes and the space shuttle		
				236	rocket engines		
				259	measuring mass in space		
				263	medical technology using waves		
				289	stethoscopes used to hear sound vibrations		
				296	ultrasound technology		
				336	fiber optics are used for surgical inspections		
				443	magnetic resonance imaging		
				451	MRI application		
				531	infrared thermometers		
				622	x-ray machines		
				623	CAT scans		

Correlation to Maine's Curriculum Framework for Science

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.C.05 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	C. Students understand that mathematics and science have changed human understanding of the universe.	5. Describe how new theories (e.g., special relativity) are continually arising and continue to challenge the current understanding of the universe.	41	Galileo and Newton conducted experiments with balls on ramps	75	the discovery of atom's nucleus
				78	Newton's laws of motion	127	when does special relativity become important?
				81	Newton's discovery of the connection between force and mass and acceleration	128	the equivalence of mass and energy
				152	Sir Isaac Newton and law of universal gravitation	197	quantum physics
				314	Einstein's theory of relativity	200	explore how a vibrating string has similar properties to a quantum system
				349	Galileo and telescopes		
				350	Newtonian reflecting telescope		
				366	relationship between matter and energy and time and space		
				367	speed of light paradox		
				368	speed and time and clocks		
				369	consequences of time dilation		
				370	Einstein's mass-energy formula		
				371	simultaneity depends on the relative motion of your frame of reference		
				382	Ben Franklin and current		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				420	Charles-Augustin de Coulomb		
				499	development of atomic theory		
				580	comparing classical and quantum physics		
				580	Newton and classical physics		
				581	classical vs. quantum theory of light		
				582	classical vs. quantum concept of electron		
				583	how the uncertainty principle differs from classical theory		
				589	electrons in classical vs. quantum physics		
				616	energy and radioactivity		
				625	nuclear reactions can convert mass into energy		
				629	conservation of particles in nuclear reactions		
				629	energy is stored as mass in nuclear reactions		
				630	antimatter and neutrinos and other particles		
				642	Einstein's theory and gravity and inertial mass		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				644	general relativity and curved space-time		
				645	black holes and general relativity		
				646	standard model of particle physics		
				647	matter and antimatter		
				647	energy released in reactions between matter and antimatter		
				648	standard model of particles		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.C.07 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	C. Students understand that mathematics and science have changed human understanding of the universe.	7. Use sophisticated mathematical modeling to analyze, interpret and predict the results of experiments.	7	creating theories based on observations	12	was this experiment better or worse than the first?
				10	the usefulness of phlogiston theory despite being incorrect	13	predict speed of ball
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	13	compare prediction to measurement
				11	Ptolemy model vs. Copernicus model of the solar system	13	create a graph
				16	describe the graph	16	create a graph
				18	how would acceleration be different?	16	describe the graph
				22	create graphs	18	how would acceleration be different?
				22	compare calculation with graph estimate	22	create graphs
				22	uniform acceleration model	22	compare calculation with graph estimate
				22	how do you measured positions compare to model?	22	uniform acceleration model
				24	create an algebraic model	22	how do you measured positions compare to model?
				28	solve second law equation for string tension	24	create an algebraic model
				29	does experiment agree with prediction?	28	solve second law equation for string tension
				32	develop a model that predicts acceleration	29	does experiment agree with prediction?
				33	calculate the predicted speed	32	develop a model that predicts acceleration
				66	developing the formulas for a model of motion with constant acceleration	33	calculate the predicted speed

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				71	parachutes and air resistance	37	use your graph to make a prediction
				103	evaluating perpetual motion claims	37	make a graph
				282	write a formula relating velocity of wave to period and wavelength	38	use your graph to make a prediction
						38	make a graph
				290	the process of digital sound reproduction	42	predict exact landing location
				297	frequency spectrum	43	sketch four graphs
				312	light intensity follows an inverse square law	43	create algebraic model
				411	the waveform of AC electricity	43	how does the measurement compare to your prediction?
				498	since wood is created from other matter it must not be a fundamental substance	49	write a formula
						56	create a graph
						65	predict where the ball moves fastest
						66	create a graph of speed vs. position
						76	compare predicted mass to actual mass
						82	make three different graphs
						87	sketch a graph
						94	give an equation that describes your observations

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
						97	reliability of a double-blind test
						97	did the method give an accurate result?
						114	are there differences between your prediction and measurement?
						132	predict what the current will be
						135	graph voltage vs. current
						136	graph voltage vs. current
						151	make a graph of voltage vs. time
						160	create a graph
						167	make a graph of voltage vs. number of magnets
						169	make a current vs. voltage graph for the diode
						189	Bernoulli's equation
						204	build models of Na and Cl and use them to explain bonding

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.D.01 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	D. Students understand that discoveries often have unforeseen consequences.	1. Evaluate the ethical use or introduction of new scientific or technological developments.	12	engineers design practical devices for solving problems		
				31	use of nanotechnology		
				72	antilock brakes application		
				112	impact of technology		
				112	designing a bridge		
				138	use of robots		
				155	geostationary satellites		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		
				217	research into tidal power		
				228	seat belts and air bags		
				235	jet engines application		
				257	quartz crystals application		
				280	microwave ovens application		
				293	uses of Doppler radar		
				311	invention of electric light		
				325	the printing press		
				349	the telescope		
				378	importance of electricity		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				392	hybrid gas/electric cars application		
				413	wiring application		
				434	how television works application		
				451	MRI application		
				490	why computers are useful		
				534	energy-efficient building application		
				623	creation of CAT scans		
				631	nuclear power application		
				641	research on future of the universe		
S.6.D.02 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	D. Students understand that discoveries often have unforeseen consequences.	2. Analyze the impacts of various scientific and technological developments.	8	Comparing a theory and a natural law	12	do your results agree with hypothesis?
				8	testing hypotheses with experiments	33	does your experiment confirm your hypothesis?
				136	determining formula for acceleration on a ramp	50	does your experiment provide confirmation?
				188	perpetual motion machines	66	does this agree with your hypothesis?
				367	speed of light did not behave as expected for Michelson and Morley	111	how does what you observed support the quantum theory?
				369	proof of time dilation		
				375	explain Thomas Young's demonstration of the wave nature of light		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.D.03 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	D. Students understand that discoveries often have unforeseen consequences.	3. Identify a current human problem; explore what areas of science, mathematics, and technology are being used to address it; discuss the limitations of these methods and develop possible strategies to overcome these limitations.	7 40 101 102 330 440 492 568 583 637 640 641	developing models to explain observations creating useful models a model for friction a model for static friction optics and optical instruments scientists have never found single magnetic poles the binary number system and its use in computers understanding how gravity works inside atoms the meaning of the uncertainty principle areas of active research in physics unresolved questions of history of universe research on future of the universe	22	model for uniform accelerated motion

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.D.04 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	D. Students understand that discoveries often have unforeseen consequences.	4. Describe the importance of serendipity (making significant discoveries by accident) in some specific science and mathematics innovations.	367 560	Einstein and theory of special relativity deep water submarine Alvin application		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.D.05 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	D. Students understand that discoveries often have unforeseen consequences.	5. Compare the costs and benefits to society of a scientific development (nuclear fission, genetic engineering).	12	engineers design practical devices for solving problems		
				31	use of nanotechnology		
				72	antilock brakes application		
				112	designing a bridge		
				112	impact of technology		
				138	use of robots		
				155	geostationary satellites		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		
				217	research into tidal power		
				228	seat belts and air bags		
				235	jet engines application		
				257	quartz crystals application		
				280	microwave ovens application		
				293	uses of Doppler radar		
				311	invention of electric light		
				325	the printing press		
				349	the telescope		
				378	importance of electricity		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				392	hybrid gas/electric cars application		
				413	wiring application		
				434	how television works application		
				451	MRI application		
				490	why computers are useful		
				534	energy-efficient building application		
				623	creation of CAT scans		
				631	nuclear power application		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.6.E.01 Secondary	6. Students Understand Historical and Societal Implications of Mathematics and Science	E. Students understand that access to developments in mathematics and science is varied throughout the world.	1. Research issues that illustrate the effects of technological imbalances and suggest some solutions.	12	all technology is based on fundamental laws of physics		
				14	using analysis and problem solving and an understanding of technology to make economic decisions		
				31	use of nanotechnology		
				51	analyzing motion with video and strobe photography		
				52	Dr. Harold Edgerton and strobe photography		
				72	antilock brakes application		
				91	biomechanics application		
				92	applications of biomechanics		
				112	relationship between science and engineering and technology		
				172	bicycle physics application		
				196	hydroelectric power application		
				235	jet engines application		
				243	oscillators are used in communications and music and clocks		
				257	quartz crystals application		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				263	waves can carry information		
				280	microwave ovens application		
				325	the printing press		
				369	technological advances have allowed discovery of the expanding universe		
				372	holography application		
				392	hybrid gas/electric cars application		
				413	wiring application		
				429	electron beam accelerators		
				434	how television works application		
				451	MRI application		
				472	maglev train application		
				473	how magplanes levitate		
				492	computers and electronic addition of numbers application		
				516	refrigerator application		
				534	energy-efficient building application		
				535	designing buildings to be energy efficient		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				560	deep water submarine Alvin application		
				585	laser application		
				585	economics of laser technology		
				615	smoke detectors		
				623	creation of CAT scans		
				631	nuclear power application		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.E.07 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	E. Students understand the structure of matter and the changes it can undergo.	7. Describe nuclear reactions, including fission, fusion, and decay, their occurrences in nature and how they can be used by humans.	502	elements past #92 are radioactive and decay	209	radioactive decay and half life
				570	radioactive isotopes	210	simulate radioactive decay
				570	use of radioactive isotopes in medicine	211	types of radiation
				573	fusion	213	fusion and fission
				573	nuclear reactions		
				614	radioactive decay		
				614	three kinds of radioactivity		
				615	alpha and beta and gamma radiation		
				616	energy and radioactivity		
				617	half-life		
				618	carbon dating		
				618	half-life calculation		
				620	ionizing and nonionizing radiation		
				620	danger of gamma rays and alpha particles		
				622	x-ray machines		
				623	CAT scans		
				624	measuring radiation with Geiger counter		
				624	danger of ionizing radiation		
				625	nuclear reactions		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				627	fusion reactions		
				628	fission reactions		
				632	nuclear energy		
				634	three kinds of radioactive decay		
				635	differences between fission and fusion		
				636	half-life of nitrogen-13		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.01 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	1. Analyze the evidence that leads scientists to conclude that light behaves somewhat like a wave and somewhat like a particle.	310	light is a form of energy	111	photons and quantum theory
				312	the intensity of light		
				313	light carries information		
				314	the speed of light		
				322	the photon theory of light		
				323	photons and the intensity of light		
				324	when the photon theory of light is useful		
				328	how is light used for communication?		
				356	light can be described in terms of waves		
				357	frequency and wavelength of light		
				358	speed of light is frequency multiplied by length		
				373	wave fronts of light		
				580	the photoelectric effect		
				581	Einstein explains the photoelectric effect		
				581	quantum or photon theory of light		
				589	photoelectric effect		
				629	conservation of particles in nuclear reactions		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				630	antimatter and neutrinos and other particles		
				646	standard model of particle physics		
				647	matter and antimatter		
				648	standard model of particles		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.02 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	2. Examine and describe how light is reflected and refracted (deflected) by mirrors and lenses.	315	light bends as it moves into a material	106	use a mirror to study how light behaves
				315	mirrors	106	study refraction in a prism
				315	light rays bounce off a surface	106	study reflection in a prism
				316	white light is the combination of all the colors	109	examining the spectrum of a light source
				324	the process of how light is reflected	112	investigate law of reflection
				331	mirrors reflect light	113	study how refraction works
				331	lenses bend light	113	investigate Snell's law of refraction
				331	prisms separate white light into its colors	114	apply Snell's law of refraction
				332	specular and diffuse reflection	114	study index of refraction
				332	the image in a mirror	114	study the critical angle of refraction in a prism
				333	finding the normal line for reflection	115	investigating the difference between an object and an image
				333	the laws of reflection	115	studying optical systems
				334	refraction is the bending of light rays	116	trace ray diagrams through a double convex lens
				334	the index of refraction	116	investigate how a converging lens bends light
				335	refraction depends on index of refraction in both materials	116	investigate how a converging lens bends light
				335	Snell's law of refraction	117	compare the image of the arrow to the original arrow

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				336	total internal reflection and the critical angle	117	sketch the image formed by a lens
				337	prisms and dispersion and rainbows	119	analyze optical systems
				338	optics in terms of objects and images	120	apply the concept of chromatic aberration
				338	how the human eye sees images	121	study the thin lens formula
				339	the image formed in a mirror		
				339	finding an image in a ray diagram		
				339	mirrors form virtual images		
				340	design of a lens		
				340	converging and diverging lenses		
				340	lenses follow Snell's law of refraction		
				341	the image formed by a lens		
				342	finding the image in a ray diagram		
				342	drawing ray diagrams of lenses		
				343	the images formed by a lens		
				343	ray diagram for a converging lens		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				344	the functions of an optical system		
				344	the brightness of an image formed by a lens		
				345	chromatic aberration and spherical aberration		
				346	calculating image and object distances for optical systems		
				346	thin lens formula		
				347	using image relay to analyze optical systems		
				347	using multiple images allows an optical system to change the size of an image		
				349	telescope as an optical system		
				352	law of reflection		
				353	identifying rays from a ray diagram		
				353	explain index of refraction		
				354	using Snell's law		
				358	index of refraction is ratio of speed of light in material to speed of light in vacuum		
				372	three-dimensional images and the human eye		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.03 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	3. Explain or demonstrate how sound waves travel.	265	wave pulse	89	making wave pulses on a string
				265	speed of a wave vs. speed of its medium	89	study wave pulses on elastic cord
				267	water waves are transverse and Slinky is longitudinal	91	is your water wave transverse or longitudinal?
				267	transverse and longitudinal waves	91	making circular waves in a ripple tank
				268	one- and two- and three-dimensional waves	91	make different types of waves in a ripple tank
				269	propagation of waves through continuous materials	91	making plane waves in a ripple tank
				275	standing waves on a string	96	investigate human perception of sound
				277	standing waves on a string		
				278	modes of a wave		
				279	modes of vibration		
				279	vibration of a drum		
				283	type of wave represented by a spring		
				284	which direction does a cork move on a water wave?		
				286	sound is a wave of pressure		
				287	frequency and pitch of sound		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				288	relationship of loudness and amplitude and pressure in sound wave		
				289	vibrations create sound		
				289	acoustics		
				291	how we know sound is a wave		
				291	pressure and amplitude of sound waves		
				292	frequency and wavelengths of sound		
				292	sound is a longitudinal wave		
				294	effect of medium and temperature on speed of sound wave		
				294	speed of sound in different materials		
				295	designing a musical instrument		
				296	design of a good concert hall		
				298	sonograms		
				300	pitch and frequency in music		
				301	echolocation and beats		
				302	musical instruments		
				303	sound from a guitar		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				306	list evidence that sound is a wave		
S.7.H.04 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	4. Analyze the relationship between kinetic and potential energy of a falling object.	191	the formula for potential energy	66	law of conservation of energy
				192	the formula for kinetic energy	68	find the total energy at each position
				193	deriving the formula for kinetic energy	68	calculate potential and kinetic energy
				194	energy transformations	72	potential to kinetic energy conversion in a pendulum
				195	applying conservation of energy for a marble rolling on a hilly track	74	investigating collisions and conservation of energy
				196	energy transformation hydroelectric plant	88	potential to kinetic energy conversions of a pendulum
				197	conservation of energy for Hoover Dam		
				199	kinetic and potential energy conversions while bouncing in a trampoline		
				212	energy flow in a pendulum		
				245	kinetic to potential energy changes in motion of an oscillator		
				253	oscillators exchange energy back and forth between potential and kinetic		
				253	harmonic motion involves both potential and kinetic energy		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.05 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	5. Use mathematics to describe the work and power in a system.	185	work and energy	63	studying the concept of work
				185	how to calculate work	64	compare output and input work
				185	physics definition of work	64	relationship between work and energy
				186	the work done by a force	70	calculate work
				187	calculating work done against gravity	70	calculate person's power
				187	work done against gravity	71	calculate work done
				188	for all machines work out cannot exceed work in	71	calculate power output for each climber
				189	relationship between work and energy	143	find the power rating of home appliances
				191	the symmetry between work and energy	164	calculate the power consumed by the motor
				191	calculate the potential energy of a cart		
				192	calculating kinetic energy depends on speed and mass		
				193	deriving the formula for kinetic energy		
				193	calculate the kinetic energy of a moving car		
				197	calculating energy supplied by Hoover Dam		
				199	concept of work		
				200	calculate work done		
				207	power is the rate of doing work or using energy		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				207	calculate power in climbing stairs		
				208	power formulas		
				208	units of power		
				209	calculating power for common devices		
				210	estimating the power in wind		
				211	estimate average input power of a person		
				211	power in biological systems		
				216	estimating the energy in tides		
				220	calculate energy and power for humans		
				220	calculate power rating		
				409	formula for calculating power in electric circuits		
				409	power and efficiency of electric cars		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.06 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	6. Describe the relationship between matter and energy and how matter releases energy through the processes of nuclear fission and fusion.	370	Einstein's mass-energy formula	128	the equivalence of mass and energy
				573	fusion	213	fusion and fission
				616	energy and radioactivity		
				625	nuclear reactions can convert mass into energy		
				627	fusion reactions		
				628	fission reactions		
				629	energy is stored as mass in nuclear reactions		
				635	differences between fission and fusion		
647	energy released in reactions between matter and antimatter						

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.07 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	7. Use mathematics to describe and predict electrical and magnetic activity (current resistance, voltage).	378	concept of electric current	131	explore the concept of electric current
				382	voltage measures differences in energy	132	explore the concept of voltage
				382	current flows through wires and carries energy	134	Ohm's law
				383	voltage and potential energy	134	study the relationship between resistance and current
				383	voltage is a measure of electric potential energy	134	apply the concept of electrical resistance
				386	concept of electrical resistance	135	derive Ohm's law from experiment
				386	relationship between current and resistance	136	use Ohm's law to calculate the resistance
				387	measuring resistance	137	parallel circuit and Ohm's law
				388	Ohm's law	137	investigate series circuits
				389	the resistance of electrical devices	138	build a parallel circuit
				390	resistance of conductors and insulators	138	apply Ohm's law to series circuits
				391	resistors	138	determining total resistance in a series circuit
				395	knowing difference between types of resistors	139	analyze parallel circuits
				396	calculation of voltage from resistance and current	139	compare series and parallel circuits
				398	series circuit defined	140	build and analyze network circuits
				398	parallel circuit defined	148	investigate Coulomb's law

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				399	adding resistance in a series circuit	159	build an electromagnet
				399	current and resistance in a series circuit	160	what happens to the strength of an electromagnet when you increase the current?
				399	calculating current in a series circuit using Ohm's law	160	find out what happens to strength of electromagnet when current is increased
				400	voltage in a series circuit		
				400	Kirchoff's voltage law	171	use Ohm's law to calculate the resistance of the transistor
				401	parallel circuits		
				401	Kirchhoff's current law		
				402	voltage and current in a parallel circuit		
				402	advantages of parallel circuits over series circuits		
				403	resistance in parallel circuits		
				403	using Ohm's law in parallel circuits		
				404	using Kirchhoff's voltage law for circuit analysis		
				404	using Ohm's law for circuit analysis		
				404	using Kirchhoff's current law for circuit analysis		
				405	analyzing a voltage divider circuit		
				405	voltage dividers		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				406	comparing series and parallel circuits		
				407	solving network circuits		
				407	solving network circuits		
				407	calculate currents and voltages in a network circuit		
				408	voltage definition		
				408	current definition		
				408	resistance definition		
				414	why series circuits are not used in homes and buildings		
				414	why parallel circuits are used in homes and buildings		
				415	compare current in a series and parallel circuit		
				416	using Ohm's law to calculate current		
				416	calculating resistance in a circuit		
				421	current is the flow of charge		
				422	negative charge of electrons and current flow		
				424	Coulomb's law		
				425	calculate force using Coulomb's law		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				431	current into and out of capacitors		
				431	voltage of a capacitor circuit		
				435	steering the electron beam on television screen		
				437	Coulomb's law is an inverse square law		
				438	calculating charge using Coulomb's law		
				456	magnetic field of a wire		
				457	force on a current in a magnetic field		
				462	electromagnets		
				463	building an electromagnet		
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy		
				465	how electromagnets are used in electric motors		
				472	electromagnet-based maglev		
				475	diagram of electromagnet		
				479	resistance of a transistor		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.H.08 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	8. Compare and contrast how conductors and superconductors work and describe their present and potential uses.	421 422 429 480	negative charges move in a conductor atomic structures of conductors and insulators and semiconductors using a conductor as shielding from electric fields conductivity and semiconductors		
S.7.H.10 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	H. Students understand the concepts of energy.	10. Describe thermodynamics and its effects.	188	for all machines work out cannot exceed work in	64	compare output and input work

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.1.01 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	1. Use mathematics to describe the law of conservation of momentum.	224	law of conservation of momentum	78	which ball had a greater change in momentum?
				225	conservation of momentum in collisions		
				226	applying conservation of momentum		
				227	momentum conservation for collisions in two and three dimensions		
				231	conservation of angular momentum examples		
				232	conservation of angular momentum		
				235	jet engines work because of conservation of momentum		
				370	Einstein's thinking about momentum of particles moving near the speed of light		
				629	conservation of momentum in nuclear reactions		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.1.02 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	2. Explain some current theories of gravitational force.	68	free fall and acceleration due to gravity	23	investigate the effect of gravity
				69	motion formulas for free fall	51	calculate gravitational force of attraction
				70	solving problems with free fall	51	investigate law of universal gravitation
				71	acceleration of gravity does not depend on mass	57	investigating rotational inertia
				75	problem understanding acceleration due to gravity		
				97	strength of gravity on Earth and Jupiter		
				98	gravity and acceleration and weightlessness		
				124	projectiles and trajectories		
				128	gravity only accelerates vertical motion		
				129	vertical motion of a projectile		
				130	projectiles launched at an angle		
				131	range of projectiles		
				134	resolving force of gravity in ramp coordinates		
				135	acceleration down an inclined plane		
				141	effects of gravity on motion of a projectile		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				152	description of law of universal gravitation		
				152	law of universal gravitation and orbital motion		
				153	formula and calculations for law of universal gravitation		
				154	orbits and gravitational force		
				154	orbital motion		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				158	compare projectile motion to orbital motion		
				158	calculate weight and acceleration due to gravity on Pluto		
				165	the motion of a tossed object		
				166	centers of mass and gravity may differ		
				168	rotational inertia and mass distribution		
				169	rotational inertia		
				170	moment of inertia		
				187	work done against gravity		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				191	potential energy comes from gravity		
				216	tides are due to force of gravity		
				233	moment of inertia examples		
				642	Newton's laws and gravity		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.1.03 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	3. Use Newton's Laws to qualitatively and quantitatively describe the motion of objects.	61	any acceleration must come from a force	26	study Newton's first law
				78	changes in motion only occur through force	27	collect data on Newton's first law
				79	all objects tend to resist changes in motion	27	explain how Newton's first law applies
				79	what systems in a car overcome the law of inertia	28	investigate Newton's second law
				80	seat belts and air bags and Newton's first law	30	Newton's third law and free body diagrams
				80	Newton's laws and cup holders	30	investigate Newton's third law
				81	Newton's second law of motion	31	draw free body diagrams and identify action-reaction pairs
				83	calculation using Newton's second law	51	calculate gravitational force of attraction
				84	Newton's second law and dynamics problems	51	investigate law of universal gravitation
				85	if there is acceleration there must be force	77	relationship between force and motion and the second law
				85	finding force from acceleration		
				85	force problems		
				87	explaining Newton's third law in terms of an astronaut moving through space		
				87	forces always occur in action-reaction pairs		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				88	Newton's third law operates on pairs of objects		
				88	explaining Newton's third law in terms of moving a skateboard		
				89	identifying which force is acting on which object		
				89	solving problems with action-reaction forces		
				90	examples of Newton's third law		
				93	problems using Newton's first law and second law		
				94	seat belt problem		
				102	the normal force as the reaction in an action-reaction pair		
				106	Newton's second law and net force		
				107	forces on a free-body diagram		
				108	equilibrium and Newton's second law		
				108	use equilibrium to find an unknown force		
				111	understanding reaction forces in terms of springs and deformation		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				112	analysis of forces on a bridge		
				116	calculate the acceleration of a toy		
				135	normal force of an inclined plane		
				136	calculating acceleration on a ramp		
				137	the vector form of Newton's second law		
				137	calculating acceleration from 3-D forces		
				137	predicting motion in three dimensions and controlling force and acceleration in space missions		
				139	determining position by triangulation and inertial navigation		
				148	direction of force determines linear or rotational motion		
				149	calculating centripetal force		
				150	using centripetal acceleration to create the feeling of gravity by rotating the space station		
				150	formula for centripetal acceleration		

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Student Text and Investigation Manual

Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				151	banked turns		
				152	description of law of universal gravitation		
				153	formula and calculations for law of universal gravitation		
				154	orbital motion		
				155	satellite motion application		
				156	satellites in orbit		
				158	calculate weight and acceleration due to gravity on Pluto		
				168	Newton's first law and rotational inertia		
				169	Newton's second law applies to rotational motion		
				171	Newton's second law for rotational motion variables		
				216	tides are due to force of gravity		
				222	Newton's first law and momentum		
				224	momentum and Newton's third law		
				228	Newton's second law relating force and momentum		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				228	seat belts and air bags		
				229	momentum form of Newton's second law		
				234	gyroscopes and the space shuttle		
				238	cars that crumple in a collision		
				240	forces in a car stopping		
				252	Newton's second law and natural frequency		
				425	electric forces always occur in pairs according to Newton's third law		
				548	Newton's third law and pressure in a fluid		
				550	pressure and the third law		
				557	pressure of gases		
				642	Newton's laws and gravity		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.1.04 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	4. Describe how forces affect fluids (e.g., air and water).	540	definition of density and density formula	175	find the density
				547	density of ice vs. liquid water	177	the density of ice vs. water
				548	forces applied to fluids create pressure	193	compare gauge and absolute pressure
				549	formula for pressure in a liquid caused by gravity		
				550	pressure and force formula		
				551	fluids flow because of pressure differences		
				555	fluids and friction		
				556	density of gases can change		
				560	pressure force on Alvin		
				561	buoyancy of Alvin		
				563	stress vs. pressure		
				622	x-rays are photons		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
S.7.1.05 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	5. Explain the relationship between temperature, heat and molecular motion.	506	temperature measures average kinetic energy	178	explore the connection between temperature and heat and energy
				509	temperature change and thermal energy	179	specific heat
				512	temperature and thermal energy and heat	182	investigate convection in a liquid
				513	joules and calories and Btus		
				513	transfer of thermal energy		
				514	specific heat and the heat equation		
				516	refrigerator application		
				520	relationship between temp and average kinetic energy		
				522	heat conduction		
				523	heat conduction		
				524	conduction in solids and liquids and gases		
				526	convection in liquids		
				527	convection depends on speed and surface area		
				528	convection and weather		
				530	radiation		
				534	R-value		
				535	sources of heat transfer in buildings		

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Standard #: Level	Guiding Principle	Content Standard	Performance Indicator	student text pg	detail	investigation pg	detail
				535	sources of heat transfer in buildings		
				538	using heat conduction equation to calculate R-value		
S.7.I.06 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	6. Describe how forces within and between atoms affect their behavior and the properties of matter.	568	forces in the atom		
				626	strong force and electromagnetic force in the nucleus		
				649	four forces in nature		
S.7.I.07 Secondary	7. Students Attain and Apply Essential Knowledge and Skills of Mathematics and Science	I. Students understand the motion of objects and how forces change that motion.	7. Recognize that there are situations in which Newton's Laws do not accurately describe motion.	580	comparing classical and quantum physics	197	quantum physics
				581	classical vs. quantum theory of light	200	explore how a vibrating string has similar properties to a quantum system
				582	classical vs. quantum concept of electron		
				583	how the uncertainty principle differs from classical theory		
				589	electrons in classical vs. quantum physics		