Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.a Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.		data tables and graphs can be created on computer or graphing calculator	1	estimating length
				18	measuring distance	6	collecting data with precision
				25	accuracy and precision of measurements	6	accuracy and resolution and printing
						15	collect time data with precision
						15	collect time data
						18	collect time data with precision
						43	measure and record the distance
						60	measure input and output forces
						67	measure vertical distance
						82	measure the length of the string

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.b Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Identify and communicate sources of unavoidable experimental error.	25 42	why accuracy and precision are important controlling variables in experiments	6 15 18 43 45 202	collecting data with precision collect time data with precision collect time data with precision discuss sources of error discuss sources of errors identify two sources of experimental error
InqHS.01.c Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.	25 42	why accuracy and precision are important controlling variables in experiments	43 45 202	discuss sources of error discuss sources of errors identify two sources of experimental error

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.d Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Formulate explanations by using logic and evidence.	2	understanding natural laws	12	cause and effect relationships
				3	connecting cause and effect through observation	16	what do the results tell you?
				7	revising explanations through observation	18	are the accelerations different?
				8	refining theories based on observations	19	does the ball accelerate?
						43	what would happen if...?
				9	connecting cause and effect through analysis	58	explain why the angular acceleration is different
				10	the usefulness of phlogiston theory despite being incorrect	80	explain your observations
						87	explain how force applied causes the response
				45	recognizing patterns and cause and effect relationships	90	what effect does changing the tension have?
				71	parachutes and air resistance	90	explain why higher tension makes waves move faster
				306	explain why hearing can be damaged by loud sounds	92	explain how wind might cause big waves in water
						109	explain how the colored filters work
						132	what conclusions can you draw?
						133	analyze data and explain a rule
						204	build models of Na and Cl and use them to explain bonding

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.e Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.	28	expressing very large and very small numbers using scientific notation	8	scientific notation practice
				34	expressing numbers in scientific notation	22	uniform acceleration model
				60	creating the acceleration formula from experiments	25	create an algebraic model
				66	developing the formulas for a model of motion with constant acceleration	28	solve second law equation for string tension
				282	write a formula relating velocity of wave to period and wavelength	32	develop a model that predicts acceleration
				312	light intensity follows an inverse square law	43	create algebraic model
						49	write a formula
						51	using scientific notation
						94	give an equation that describes your observations
						189	Bernoulli's equation

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.f Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Distinguish between hypothesis and theory as scientific terms.	8	formulating a hypothesis	11	formulate a testable hypothesis
				8	Comparing a theory and a natural law	12	do your results agree with hypothesis?
				8	testing hypotheses with experiments	33	formulate a testable hypothesis
				9	testing ideas against scientific evidence	33	does your experiment confirm your hypothesis?
				136	determining formula for acceleration on a ramp	43	follow the scientific method
				188	perpetual motion machines	43	perform experiment
				242	finding a basic cycle of harmonic motion	48	formulate a hypothesis
				367	speed of light did not behave as expected for Michelson and Morley	50	does your experiment provide confirmation?
						65	form a hypothesis
				369	proof of time dilation	65	investigate motion on a roller coaster
				375	explain Thomas Young's demonstration of the wave nature of light	66	does this agree with your hypothesis?
				456	an experiment with a wire and compass	67	investigate motion on a roller coaster
				463	building an electromagnet with wire and a nail	79	write a hypothesis
				467	experiment demonstrating electromagnetic induction	82	plan three experiments to determine which variable affects the period of a pendulum
						111	how does what you observed support the quantum theory?

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.g Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Recognize the usefulness and limitations of models and theories as scientific representations of reality.	7	developing models to explain observations	13	create a graph
				11	Ptolemy model vs. Copernicus model of the solar system	13	compare prediction to measurement
				40	making a good model	16	describe the graph
				40	creating useful models	16	create a graph
				43	constructing a graph	22	create graphs
				44	graphical models	22	compare calculation with graph estimate
				44	using a graphical model to make a prediction and checking the model's accuracy	22	how do you measured positions compare to model?
				54	constructing a graph	22	uniform acceleration model
				55	create a graph from a data table	22	model for uniform accelerated motion
				60	creating the acceleration formula from experiments	25	create an algebraic model
				66	developing the formulas for a model of motion with constant acceleration	28	solve second law equation for string tension
				101	a model for friction	29	does experiment agree with prediction?
				102	a model for static friction	32	develop a model that predicts acceleration
				282	write a formula relating velocity of wave to period and wavelength	37	make a graph
				290	the process of digital sound reproduction	38	make a graph
				297	frequency spectrum	43	how does the measurement compare to your prediction?
						43	create algebraic model

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
				312 light intensity follows an inverse square law 330 optics and optical instruments 411 the waveform of AC electricity 492 the binary number system and its use in computers	43 sketch four graphs 49 write a formula 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 94 give an equation that describes your observations 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 189 Bernoulli's equation

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.j Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Recognize the issues of statistical variability and the need for controlled tests.	40	defining variables	11	recognizing and controlling variables
				42	control and experimental variables	25	find the average time
				42	writing lab procedures	43	write a procedure
				43	dependent and independent variables in graphs	58	find average of three trials
						67	calculate average of three times
				54	importance of changing one variable at a time in an experiment	71	calculate average work and power
				251	changing the natural frequency of a stretched rubber band	82	determine which variable has the greatest effect
						82	dependent and independent variables
				412	average voltage and current of AC power	166	variables that affect the performance of the generator
						201	develop a procedure

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
InqHS.01.k Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Recognize the cumulative nature of scientific evidence.	7	in science inquiry is used to uncover truth	
				560	deep water submarine Alvin application	
				641	research on future of the universe	
				644	proof of Einstein's theory of general relativity	
				645	astronomers find black holes by what is around them	
InqHS.01.l Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Analyze situations and solve problems that require combining and applying concepts from more than one area of science.	13	medical and health professions use physics	
				16	the relation between physics and other fields of science	
				91	biomechanics application	
				449	Earth's magnetism	
				498	search for answers in physics and chemistry	
				592	connections between biology and chemistry and physics	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.m Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources…	12	engineers design practical devices for solving problems	143	the cost of using electrical appliances
				31	use of nanotechnology		
				72	antilock brakes application		
				112	designing a bridge		
				138	use of robots		
				155	geostationary satellites		
				196	environmental impacts of hydroelectric power		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		
				217	advantages of tidal energy		
				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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				378	importance of electricity	
				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	
				602	hydrogen as a fuel	
				607	impact of combustion reaction of gasoline	
				608	alternate fuels to gasoline	
				618	power released by radioactive decay	
				623	creation of CAT scans	
				631	nuclear power application	
				632	nuclear energy	
				634	comparison of fission and fusion	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
InqHS.01.n Investigation and Experimentation	Standard	Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop questions and perform investigations.	Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent and that the theory is sometimes wrong.	4	inquiry through observation	12	was this experiment better or worse than the first?
				7	revising explanations through observation	43	test your prediction
				7	creating explanations through observation	65	where does the marble move the fastest?
				8	forming hypotheses and testing with experiments	97	reliability of a double-blind test
				8	refining theories based on observations	97	did the method give an accurate result?
				10	putting forth ideas and then testing them	111	do your observations support this hypothesis?
				10	the usefulness of phlogiston theory despite being incorrect	111	how does what you observed support the quantum theory?
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	147	how did A and B tapes acquire different charge?
						202	identify two sources of experimental error
				25	why accuracy and precision are important	204	build models of Na and Cl and use them to explain bonding
				44	checking a graphical model's accuracy		
				71	parachutes and air resistance		
				103	evaluating perpetual motion claims		
				136	determining formula for acceleration on a ramp		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	
				367	speed of light did not behave as expected for Michelson and Morley	
				369	proof of time dilation	
				375	explain Thomas Young's demonstration of the wave nature of light	
				423	charge by friction	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.a Physics	Motion and Forces	Newton's law predicts the motion of most objects.	Students know how to solve problems that involve constant speed and average speed.	37	how to calculate speed	9	collect data and calculate speed of car
				48	determining speed from the slope of a position vs. time graph	10	make object move with speed of 1 m/sec
				55	calculate the average speed and distance traveled	12	finding speed of ball with one photogate
						14	find the speed of the ball
				64	calculate speed in accelerated motion	15	find speed of the ball
				75	calculations of speed	17	find two speeds
				146	calculating linear speed of a moving wheel	21	calculate speed of ball
						26	make ball roll at constant speed
				147	the linear speed of a rolling wheel	33	calculate the predicted speed
						42	find initial speed of ball
						50	calculate the speed of the ball
						66	find the speed of the ball
						68	what is speed of the ball?
						76	calculate speeds of projectile and target balls
						90	calculate the speed of the wave pulse
						191	calculate speed of air in homemade air-speed tester

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.b Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).	61	any acceleration must come from a force	26	collect data on Newton's first law
				78	changes in motion only occur through force	26	study Newton's first law
				79	all objects tend to resist changes in motion	27	explain how Newton's first law applies
				85	if there is acceleration there must be force	49	consider forces acting on the ball
				94	seat belt problem		
				99	balanced force problems		
				133	balancing forces in two dimensions		
				148	direction of force determines linear or rotational motion		
				168	Newton's first law and rotational inertia		
				222	Newton's first law and momentum		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.c Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to apply the law F=ma to solve one-dimensional motion problems that involve constant forces (Newton's second law).	81	Newton's second law of motion	28	investigate Newton's second law
				83	calculation using Newton's second law	77	relationship between force and motion and the second law
				84	Newton's second law and dynamics problems		
				85	force problems		
				85	finding force from acceleration		
				93	problems using Newton's first law and second law		
				106	Newton's second law and net force		
				108	equilibrium and Newton's second law		
				108	use equilibrium to find an unknown force		
				116	calculate the acceleration of a toy		
				136	calculating acceleration on a ramp		
				137	calculating acceleration from 3-D forces		
				137	the vector form of Newton's second law		
				149	calculating centripetal force		
				150	formula for centripetal acceleration		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				169	Newton's second law applies to rotational motion	
				171	Newton's second law for rotational motion variables	
				228	Newton's second law relating force and momentum	
				229	momentum form of Newton's second law	
				252	Newton's second law and natural frequency	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.d Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).	87	forces always occur in action-reaction pairs	30	Newton’s third law and free body diagrams
				88	Newton's third law operates on pairs of objects	30	investigate Newton’s third law
				89	solving problems with action-reaction forces	31	draw free body diagrams and identify action-reaction pairs
				89	identifying which force is acting on which object		
				102	the normal force as the reaction in an action-reaction pair		
				107	forces on a free-body diagram		
				111	understanding reaction forces in terms of springs and deformation		
				112	analysis of forces on a bridge		
				135	normal force of an inclined plane		
				224	momentum and Newton's third law		
				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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.e Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.	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		
				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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				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	calculate weight and acceleration due to gravity on Pluto	
				158	compare projectile motion to orbital motion	
				165	the motion of a tossed object	
				166	centers of mass and gravity may differ	
				187	work done against gravity	
				191	potential energy comes from gravity	
				216	tides are due to force of gravity	
				642	Newton's laws and gravity	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.f Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g.,Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).	148	acceleration can be a change in the direction of motion	49	investigating centripetal force
				149	calculating centripetal force	51	calculate gravitational force of attraction
				152	description of law of universal gravitation	51	investigate law of universal gravitation
				153	formula and calculations for law of universal gravitation		
				154	orbital motion		
				154	satellites and orbital motion		
				155	satellite motion application		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				156	HEO and geostationary orbit		
				158	calculate weight and acceleration due to gravity on Pluto		
				158	calculating centripetal force		
				216	tides are due to force of gravity		
				243	orbit is a type of cycle		
				460	orbital motion of a charge		
				642	Newton's laws and gravity		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.g Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know circular motion requires the application of a constant force directed towards the center of the circle.	148	acceleration can be a change in the direction of motion	49	investigating centripetal force
				149	calculating centripetal force		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				158	calculating centripetal force		
				460	orbital motion of a charge		
PhysHS.01.h Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know Newton's laws are not exact but provide very good approximations unless an object is moving close to the speed of light or is small enough that quantum effects are important.	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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.I Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to solve two-dimensional trajectory problems.	68	free fall and acceleration due to gravity	23	investigate the effect of gravity
				69	motion formulas for free fall		
				70	solving problems with free fall		
				71	acceleration of gravity does not depend on mass		
				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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				152	law of universal gravitation and orbital motion	
				154	orbits and gravitational force	
				155	centripetal force and the law of universal gravitation combine to form the orbit equation	
				158	compare projectile motion to orbital motion	
				165	the motion of a tossed object	
				166	centers of mass and gravity may differ	
				187	work done against gravity	
				191	potential energy comes from gravity	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.01.j Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to resolve two-dimensional vectors into their components and calculate the magnitude and direction of a vector from its components.	119 adding vectors 120 adding vectors 121 adding and subtracting vectors 122 calculating vector components 123 finding magnitude and angle of a vector 125 the velocity vector 126 components of the velocity vector 127 adding velocity vectors 128 independence of horizontal and vertical motion in a velocity vector 130 calculating velocity components of initial velocity 132 the force vector describes the strength and direction of a force 132 interpreting the x-y components of force 133 calculating components of a force vector	41 calculate the resultant vector 45 calculate force components

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.k Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to solve two-dimensional problems involving balanced forces (statics).	89	solving problems with action-reaction forces	30	Newton's third law and free body diagrams
				99	balanced force problems	31	draw free body diagrams and identify action-reaction pairs
				107	forces on a free-body diagram	49	consider forces acting on the ball
				112	analysis of forces on a bridge		
				133	balancing forces in two dimensions		
				135	normal force of an inclined plane		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.01.l Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to solve problems in circular motion by using the formula for centripetal acceleration in the following form: a=v2/r.	144	rotation and revolution and angular speed	46	investigating angular speed
				145	calculating angular speed in radians per second	46	contrasting linear and angular motion
				146	angular speed of a moving wheel	49	investigating centripetal force
				146	the relationship between linear and angular speed		
				147	speedometers and odometers		
				148	acceleration can be a change in the direction of motion		
				149	calculating centripetal force		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				157	compare linear and angular speeds		
				158	calculating centripetal force		
				160	translation and rotation		
				171	rotational motion and linear motion		
				231	linear and angular momentum		
				238	compare linear and angular momentum		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
				460	orbital motion of a charge		
PhysHS.01.m Physics	Motion and Force	Newton's law predicts the motion of most objects.	Students know how to solve problems involving the forces between two electric charges at a distance (Coulomb's law) or the forces between two masses at a distance (universal gravitation).	152	description of law of universal gravitation	51	calculate gravitational force of attraction
				153	formula and calculations for law of universal gravitation	51	investigate law of universal gravitation
				154	orbital motion	148	investigate Coulomb's law
				158	calculate weight and acceleration due to gravity on Pluto		
				216	tides are due to force of gravity		
				424	Coulomb's law		
				425	calculate force using Coulomb's law		
				437	Coulomb's law is an inverse square law		
				438	calculating charge using Coulomb's law		
				642	Newton's laws and gravity		
PhysHS.02.a Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to calculate kinetic energy by using the formula E=(1/2)mv2.	191	the formula for potential energy	68	calculate potential and kinetic energy
				192	the formula for kinetic energy		
				193	deriving the formula for kinetic energy		
				253	harmonic motion involves both potential and kinetic energy		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.b Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) = mgh (h is the change in the elevation).	191 192 193 253	the formula for potential energy the formula for kinetic energy deriving the formula for kinetic energy harmonic motion involves both potential and kinetic energy	68	calculate potential and kinetic energy

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.c Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.	194	conservation of energy explained	66	law of conservation of energy
				194	the law of conservation of energy	68	find the total energy at each position
				195	conservation of energy in a closed system	74	investigating collisions and conservation of energy
				195	applying conservation of energy for a marble rolling on a hilly track		
				197	conservation of energy for Hoover Dam		
				203	efficiency and conservation of energy		
				206	connection between efficiency and time		
				215	energy flows in biological systems		
				227	kinetic energy conservation for elastic collisions		
				370	relationship and conservation of mass and energy		
				469	energy conservation and Faraday's law		
				515	thermodynamics and conservation of energy		
				552	conservation of energy in fluids		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
				553	energy conservation and Bernoulli's equation		
				629	conservation of energy in nuclear reactions		
PhysHS.02.d Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to calculate momentum as the product mv.	222	comparison of kinetic energy and momentum	73	momentum is a vector
				223	momentum is a vector	80	angular momentum behaves like a vector
				237	why is momentum a vector		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.e Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know momentum is separately conserved quantity different from energy.	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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.f Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know an unbalanced force on an object produces a change in its momentum.	99	balanced force problems	49	consider forces acting on the ball
				133	balancing forces in two dimensions	73	calculating momentum
				223	momentum formula and calculating momentum	75	investigate collisions and conservation of momentum
				226	solving elastic and inelastic collision problems	77	the momentum form of Newton's second law
				229	force on a rocket from change in momentum		
				230	calculate change in momentum for elastic vs. inelastic collisions		
				236	momentum conservation of turbofan engine		
				238	momentum in billiards		
				239	calculate momentum		
				276	natural frequency and harmonics		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.g Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to solve problems involving elastic and inelastic collisions in one-dimension by using the principles of conservation of momentum and energy.	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		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.02.h Physics	Conservation of Energy and Momentum	The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.	Students know how to solve problems involving conservation of energy in simple systems with various sources of potential energy, such as capacitors and springs.	194	conservation of energy explained	66	law of conservation of energy
				194	the law of conservation of energy	68	find the total energy at each position
				195	conservation of energy in a closed system	74	investigating collisions and conservation of energy
				195	applying conservation of energy for a marble rolling on a hilly track		
				197	conservation of energy for Hoover Dam		
				203	efficiency and conservation of energy		
				206	connection between efficiency and time		
				215	energy flows in biological systems		
				227	kinetic energy conservation for elastic collisions		
				370	relationship and conservation of mass and energy		
				469	energy conservation and Faraday's law		
				515	thermodynamics and conservation of energy		
				552	conservation of energy in fluids		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				553	energy conservation and Bernoulli's equation	
				629	conservation of energy in nuclear reactions	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.03.a Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know heat flow and work are two forms of energy transfer between systems.	188	for all machines work out cannot exceed work in	64	compare output and input work
				190	conversions of energy	67	friction as a source of energy dissipation
				194	energy transformations	72	draw an energy flow diagram
				195	friction can divert some energy	182	investigate convection in a liquid
				196	energy transformation hydroelectric plant		
				202	efficiency and energy conversions		
				203	how friction affects machines		
				205	efficiency in biological systems		
				206	friction and the arrow of time		
				212	energy conversion		
				213	the conversion process of energy flow		
				216	tidal energy represents frictional energy from the Earth-moon system		
				219	energy flow of a model solar car		
				245	friction causes damping in oscillators		
				256	resonant systems accumulate energy		

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				277	waves propagate by exchanging energy between two forms	
				320	photosynthesis converts light energy to chemical energy	
				324	light from chemical reactions	
				356	electromagnetic waves exchange energy between electricity and magnetic parts	
				393	conversion of energy in regenerative braking	
				400	energy conversions in a series circuit	
				451	MRI--energy exchange by a nucleus in a magnetic field	
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy	
				467	electric generators transform mechanical energy into electric energy	
				509	temperature change and thermal energy	
				513	transfer of thermal energy	
				522	heat conduction	
				523	heat conduction	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				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	
				535	sources of heat transfer in buildings	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.03.b Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know that the work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature and that this is in an example of the law of conservation	194	energy transformations	72	potential to kinetic energy conversion in a pendulum
				196	energy transformation hydroelectric plant	88	potential to kinetic energy conversions of a pendulum
				196	hydroelectric power system		
				197	efficiency of the Hoover Dam		
				199	kinetic and potential energy conversions while bouncing in a trampoline		
				212	energy flow in a pendulum		
				217	extracting tidal power		
				245	kinetic to potential energy changes in motion of an oscillator		
				253	oscillators exchange energy back and forth between potential and kinetic		
				470	energy for generators		
				509	temperature change and thermal energy		
				513	transfer of thermal energy		
				516	refrigerator application		
				535	sources of heat transfer in buildings		
				631	nuclear power application		
				631	nuclear power application		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.03.c Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know the internal energy of an object includes the energy of random motion of the object's atoms and molecules, often referred to as thermal energy. The greater the temerature of the object energy of motion of the atoms and molecules…	509 temperature change and thermal energy 512 temperature and thermal energy and heat 513 transfer of thermal energy 514 specific heat and the heat equation 516 refrigerator application 535 sources of heat transfer in buildings	178 explore the connection between temperature and heat and energy 179 specific heat

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.03.d Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know that most processes tend to decrease the order of a system over time and that energy levels are eventually distributed uniformly.	194	energy transformations	72	potential to kinetic energy conversion in a pendulum
				196	energy transformation hydroelectric plant	88	potential to kinetic energy conversions of a pendulum
				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		
				506	temperature measures average kinetic energy		
				513	definition of calorie		
				513	balance of thermal energy		
				514	the heat equation		
				517	air conditioners		
				520	relationship between temp and average kinetic energy		
				522	thermal equilibrium		
				523	thermal conductors and insulators		
				537	heat flow between objects of different temperature		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
PhysHS.03.e Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know that entropy is a quantity that measures the order or disorder of a system and that quantity is larger for a more disordered system.	204	efficiency in natural systems	
				212	universe is matter and energy organized in systems	
				225	form changes in inelastic collisions	
				255	a system view of resonance	
				366	relationships between matter and energy in theory of special relativity	
				370	the equivalence of energy and matter	
				379	examples of circuits in nature	
				420	lightning and electric charge	
				522	heat transfer in living things	
				582	matter and energy in quantum theory	
				616	matter and energy and radioactivity	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.03.f Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know that statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics).	86	zero net force in equilibrium	44	forces in equilibrium
				99	weight in equilibrium problems	179	specific heat
				106	definition of equilibrium		
				108	applications of equilibrium		
				111	equilibrium and reaction or normal forces		
				115	understanding of equilibrium		
				133	equilibrium of forces and balancing forces		
				163	rotational equilibrium		
				175	explain rotational equilibrium		
				194	conservation of energy		
				204	efficiency in natural systems		
				212	universe is matter and energy organized in systems		
				214	steady state energy balance of Earth		
				248	harmonic motion and equilibrium		
				250	stable and unstable equilibrium		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				251	restoring forces and inertia affect natural frequency	
				264	equilibrium level of waves	
				366	relationships between matter and energy in theory of special relativity	
				370	the equivalence of energy and matter	
				379	examples of circuits in nature	
				514	specific heat and the heat equation	
				522	thermal equilibrium	
				522	heat transfer in living things	
				582	matter and energy in quantum theory	
				616	matter and energy and radioactivity	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.03.g Physics	Heat and Thermodynamics	Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat.	Students know how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.	185	how to calculate work	64	compare output and input work
				187	calculating work done against gravity	69	calculate efficiency for each ball
				188	for all machines work out cannot exceed work in	70	calculate work
				202	definition of efficiency	70	calculate person's power
				203	efficiency explained	71	calculate work done
				207	calculate power in climbing stairs	71	calculate power output for each climber
				208	power formulas		
				210	estimating the power in wind		
				211	power in biological systems		
				213	efficiency of an energy flow process		
				219	ideal vs. real machine		
				220	calculate efficiency of model solar car		
				220	calculate power rating		
				236	fuel efficiency of turbofan engines		
				311	efficiency of electric vs. fluorescent light bulbs		
				393	efficiency of hybrid cars		
				409	power and efficiency of electric cars		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.04.a Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know waves carry energy from one place to another.	262	waves transmit energy	95	waves carry energy from one place to another
				263	waves are a form of traveling energy		
				272	waves transfer energy through absorption		
				277	energy of a wave		
				530	energy and radiation relationships		
PhysHS.04.b Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).	265	wave pulse	89	making wave pulses on a string
				267	transverse and longitudinal waves	89	study wave pulses on elastic cord
				267	water waves are transverse and Slinky is longitudinal	91	is your water wave transverse or longitudinal?
				268	one- and two- and three-dimensional waves	91	making circular waves in a ripple tank
				275	standing waves on a string	91	make different types of waves in a ripple tank
				277	standing waves on a string	91	making plane waves in a ripple tank
				278	modes of a wave		
				279	modes of vibration		
				283	type of wave represented by a spring		
				292	sound is a longitudinal wave		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.04.c Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know how to solve problems involving wavelength, frequency, and wave speed.	264	frequency and amplitude and wavelength in waves	88	if frequency is increased what happens to total energy?
				265	concept of speed of a wave	90	study the speed of the wave pulse
				266	formula for speed of a wave	94	investigate the wavelength of standing waves
				277	energy of a wave is proportional to frequency and amplitude	94	investigate the frequency of standing waves
				278	wavelength of a standing wave		
				282	describe relationship between wave characteristics		
				292	importance of wavelength of sound waves		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
PhysHS.04.d Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.	265	speed of a wave vs. speed of its medium	
				269	propogation of waves through continuous materials	
				284	which direction does a cork move on a water wave?	
				286	sound is a wave of pressure	
				286	sound waves require matter to traverse	
				287	frequency and pitch of sound	
				288	relationship of loudness and amplitude and pressure in sound wave	
				289	vibrations create sound	
				291	how we know sound is a wave	
				291	pressure and amplitude of sound waves	
				292	frequency and wavelengths of sound	
				294	speed of sound in different materials	
				294	effect of medium and temperature on speed of sound wave	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				300	pitch and frequency in music	
				306	list evidence that sound is a wave	
				530	electromagnetic radiation	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.04.e Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3 x 10^8m/s (186,000 miles/second).	281	microwaves	122	study properties of the electromagnetic spectrum
				310	light is a form of energy		
				311	fluorescent bulbs create UV light		
				312	the intensity of light		
				313	light carries information		
				314	the speed of light		
				320	the energy of IR and UV light		
				320	visible light has just the right energy for life		
				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		
				359	waves of the electromagnetic spectrum		
				359	description and examples of infrared waves		
				360	description and examples of ultraviolet waves		
				360	visible light waves		
				373	wave fronts of light		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				531	thermal radiation and infrared light	
				624	UV light is ionizing radiation	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.04.f Physics	Waves	Waves have characteristic properties that do not depend on the type of wave.	Students know how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.	270	waves and absorption	92	observing reflection in water waves
				270	waves and refraction	92	investigate reflection in a ripple tank
				270	waves and diffraction	92	investigate diffraction in a ripple tank
				270	waves and reflection	101	investigate interference with sound waves
				271	waves and refraction and boundaries	125	polarization of water waves
				271	waves and reflection and boundaries	125	polarization of a spring wave
				272	waves and absorption and boundaries	126	study the polarization of light
				272	waves and diffraction and boundaries	126	polarization of light
				273	sound and light waves and interference		
				273	constructive and destructive interference		
				274	resonance and reflection		
				278	nodes and antinodes		
				293	definition of the Doppler effect		
				294	Doppler effect and supersonic and subsonic motion		
				295	standing wave patterns of sound		
				296	interference of sound waves		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				301	consonance and dissonance and beats	
				306	beats in a musical sound	
				307	understanding of Doppler effect	
				356	electromagnetic waves are oscillations of an energy field	
				363	polarization	
				364	polarizers	
				365	applications of polarization	
				530	absorption of thermal radiation	
				638	Doppler effect and red shift	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.a Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know how to predict the voltage or current in simple direct current(DC) electric circuits constructed from batteries, wires, resistors, and capacitors.	378 concept of electric current 379 concept of a circuit 380 circuit diagrams and electrical symbols 380 understanding simple circuit and its diagram 381 open and closed circuits 381 definition of short circuit 381 how batteries work in a circuit 382 voltage measures differences in energy 382 current flows through wires and carries energy 383 voltage is a measure of electric potential energy 383 voltage is a measure of electric potential energy 383 voltage and potential energy 384 batteries use chemical reactions to provide energy to a circuit 384 battery uses chemical energy to produce electrical charge 386 simple bulb and battery circuits to illustrate electrical resistance	129 construct simple electric circuits 129 short circuit precautions 130 understand the difference between open and closed circuits 130 draw and interpret circuit diagrams 131 construct a simple circuit 131 short circuit precautions 131 explore the concept of electric current 132 explore the concept of voltage 137 investigate series circuits 137 parallel circuit and Ohm's law 138 build a parallel circuit 139 analyze parallel circuits 139 compare series and parallel circuits 140 build and analyze network circuits 150 short circuit precautions 150 investigate how capacitors work

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
				388	calculate the current flowing in a circuit	151	what is the difference between a capacitor and a battery?
				393	hybrid car battery technology		
				395	where does energy supplied by a battery come from?		
				398	parallel circuit defined		
				398	series circuit defined		
				399	current and resistance in a series circuit		
				400	Kirchoff's voltage law		
				400	voltage in a series circuit		
				400	batteries and cells		
				401	parallel circuits		
				401	Kirchhoff's current law		
				402	advantages of parallel circuits over series circuits		
				402	short circuits		
				402	voltage and current in a parallel circuit		
				403	resistance in parallel circuits		
				404	using Kirchhoff's voltage law for circuit analysis		
				404	using Kirchhoff's current law for circuit analysis		
				405	voltage dividers		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				405	analyzing a voltage divider circuit	
				406	comparing series and parallel circuits	
				407	solving network circuits	
				407	solving network circuits	
				408	current definition	
				408	voltage definition	
				414	why parallel circuits are used in homes and buildings	
				414	why series circuits are not used in homes and buildings	
				415	explain short circuit	
				415	compare current in a series and parallel circuit	
				421	current is the flow of charge	
				422	negative charge of electrons and current flow	
				430	capacitor is a storage device for electric charge	
				431	current into and out of capacitors	
				431	voltage of a capacitor circuit	
				431	circuit symbol for a capacitor	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
				431	simple capacitor circuit		
				432	how a capacitor works and making a simple capacitor		
				433	calculating capacitance		
				438	calculating capacitance		
PhysHS.05.b Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know how to solve problems involving Ohm's law.	386	relationship between current and resistance	134	Ohm’s law
				388	Ohm's law	135	derive Ohm’s law from experiment
				396	calculation of voltage from resistance and current	136	use Ohm’s law to calculate the resistance
				399	calculating current in a series circuit using Ohm's law	138	apply Ohm’s law to series circuits
				403	using Ohm's law in parallel circuits	171	use Ohm’s law to calculate the resistance of the transistor
				404	using Ohm's law for circuit analysis		
				407	calculate currents and voltages in a network circuit		
				416	using Ohm's law to calculate current		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.c Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know any resistive element in a DC circuit dissipates energy, which heats the resistor. Students can calculate the power (rate of energy dissipation) in any resistive circuit element by using the formula Power = IR.	386 concept of electrical resistance 387 measuring resistance 389 the resistance of electrical devices 390 resistance of conductors and insulators 391 resistors 395 knowing difference between types of resistors 399 adding resistance in a series circuit 408 resistance definition 409 formula for calculating power in electric circuits 411 definition of DC current 416 calculating resistance in a circuit 478 diodes and AC to DC adapters 479 resistance of a transistor 484 rectifier circuit converts AC electricity to DC	134 study the relationship between resistance and current 134 apply the concept of electrical resistance 138 determining total resistance in a series circuit 143 find the power rating of home appliances 164 calculate the power consumed by the motor

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.05.d Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know the properties of transistors and the role of transistors in electric circuits.	478	diodes and the bias voltage	168	explore the properties of diodes
				479	transistors	170	understand the uses of transistors in circuits
				483	p-n junction is a diode	170	measure voltage and current characteristics of a transistor
				485	transistors act as electronic switches		
				486	a transistor amplifier		
				487	electronic logic and transistor circuits		
				495	knowing a diode's bias voltage		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.e Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know charged particles are sources of electric fields and are subject to the forces of the electric fields from other charges.	418 electric charge is a fundamental property of matter 419 electric forces are created between electric charges 420 explanation of coulomb 421 current is the flow of charge 422 negative charge of electrons and current flow 423 static electricity and charge polarization and induction 424 relationship of electric force and charge 425 the force between charges 426 fields and forces 426 charge creates an electric field 427 an electric field exists around a charge 428 source charges and test charges 430 a capacitor stores charge 433 ability of a capacitor to store charge is capacitance 437 strength of an electric field	146 build a simple electroscope 147 investigate the concept of electric charge 149 investigate charged balloons 154 how are magnetic field lines similar to electric field lines?

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				443	magnets create a magnetic field around them	
				649	every field has an associated particle	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.f Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.	426 fields and forces 427 an electric field exists around a charge 435 steering the electron beam on television screen 437 strength of an electric field 440 magnetism explained 443 understanding magnetic fields 443 magnets create a magnetic field around them 445 alignment of domains responds to magnetic fields 446 creating permanent magnets 447 the magnetic field of Earth 448 a compass is a magnet that lines up with Earth's magnetic field 449 the strength of Earth's magnetic field 451 magnetic field of a nucleus 454 magnetic field between two unlike poles 456 magnetic field of a wire 457 force on a current in a magnetic field	152 investigate magnetic forces 154 how are magnetic field lines similar to electric field lines? 154 draw magnetic field lines for a bar magnet 155 test materials to see if they are affected by magnets 159 build an electromagnet 160 find out what happens to strength of electromagnet when current is increased 160 what happens to the strength of an electromagnet when you increase the current? 161 experiment with pushes and pulls of permanent magnet in a rotor 165 investigate Faraday’s law of induction

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				458	the magnetic field of loops and coils	
				459	the magnetic field of coils and permanent magnets	
				460	magnetic force on a moving charge	
				461	calculating magnetic fields and forces	
				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	
				468	magnetic flux	
				469	Faraday's law of induction	
				472	electromagnet-based maglev	
				473	Eddy currents	
				475	diagram of electromagnet	
				649	every field has an associated particle	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.05.g Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know how to determine the direction of a magnetic field produced by current flowing in a straight wire or in a coil.	457 462 475	right-hand rule finding the poles of an electromagnet using right-hand rule using right-hand rule	160	study the right-hand rule
PhysHS.05.h Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.	467 471	concept of electromagnetic induction transformers operate on electromagnetic induction	165	investigate electromagnetic induction
PhysHS.05.I Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know plasmas, the fourth state of matter, contains ions or free electrons or both and conduct electricity.	30 507 508	description of plasma state high temperatures and plasma plasma as a phase of matter		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.j Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know electric and magnetic fields contain energy and act as vector force fields.	426 fields and forces 427 an electric field exists around a charge 437 strength of an electric field 440 magnetism explained 443 magnets create a magnetic field around them 443 understanding magnetic fields 445 alignment of domains responds to magnetic fields 446 creating permanent magnets 447 the magnetic field of Earth 448 a compass is a magnet that lines up with Earth's magnetic field 449 the strength of Earth's magnetic field 451 magnetic field of a nucleus 454 magnetic field between two unlike poles 458 the magnetic field of loops and coils 459 the magnetic field of coils and permanent magnets	152 investigate magnetic forces 154 draw magnetic field lines for a bar magnet 154 how are magnetic field lines similar to electric field lines? 155 test materials to see if they are affected by magnets 161 experiment with pushes and pulls of permanent magnet in a rotor

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				460	magnetic force on a moving charge	
				461	calculating magnetic fields and forces	
				649	every field has an associated particle	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.k Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know the force on a charged particle in an electric field is qE, where E is the electric field at the position of the particle and q is the charge of the particle.	418 electric charge is a fundamental property of matter 419 electric forces are created between electric charges 420 explanation of coulomb 421 current is the flow of charge 422 negative charge of electrons and current flow 423 static electricity and charge polarization and induction 424 relationship of electric force and charge 425 the force between charges 426 charge creates an electric field 428 source charges and test charges 430 a capacitor stores charge 433 ability of a capacitor to store charge is capacitance	146 build a simple electroscope 147 investigate the concept of electric charge 149 investigate charged balloons

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.l Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know how to calculate the electric field resulting from a point charge.	418 electric charge is a fundamental property of matter 419 electric forces are created between electric charges 420 explanation of coulomb 421 current is the flow of charge 422 negative charge of electrons and current flow 423 static electricity and charge polarization and induction 424 relationship of electric force and charge 425 the force between charges 426 charge creates an electric field 428 source charges and test charges 430 a capacitor stores charge 433 ability of a capacitor to store charge is capacitance	146 build a simple electroscope 147 investigate the concept of electric charge 149 investigate charged balloons

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.05.m Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know static electric fields have as their source some arrangement of electric charges.	418	electric charge is a fundamental property of matter	146	build a simple electroscope
				419	electric forces are created between electric charges	147	investigate the concept of electric charge
				420	explanation of coulomb	149	investigate charged balloons
				421	current is the flow of charge	154	how are magnetic field lines similar to electric field lines?
				422	negative charge of electrons and current flow		
				423	static electricity and charge polarization and induction		
				424	relationship of electric force and charge		
				425	the force between charges		
				426	fields and forces		
				426	charge creates an electric field		
				427	an electric field exists around a charge		
				428	source charges and test charges		
				430	a capacitor stores charge		
				433	ability of a capacitor to store charge is capacitance		
				437	strength of an electric field		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				443	magnets create a magnetic field around them	
				649	every field has an associated particle	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page	
PhysHS.05.n Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know the magnitude of the force on a moving particle in a magnetic field is qvB sin(a), where a is the angle between v and B, and the students use the right-hand rule to find the direction of this force.	440	magnetism explained	152	investigate magnetic forces
				443	understanding magnetic fields	154	draw magnetic field lines for a bar magnet
				445	alignment of domains responds to magnetic fields	155	test materials to see if they are affected by magnets
				446	creating permanent magnets	160	study the right-hand rule
				447	the magnetic field of Earth	161	experiment with pushes and pulls of permanent magnet in a rotor
				448	a compass is a magnet that lines up with Earth's magnetic field		
				449	the strength of Earth's magnetic field		
				451	magnetic field of a nucleus		
				454	magnetic field between two unlike poles		
				457	right-hand rule		
				458	the magnetic field of loops and coils		
				459	the magnetic field of coils and permanent magnets		
				460	magnetic force on a moving charge		
				461	calculating magnetic fields and forces		
				462	finding the poles of an electromagnet using right-hand rule		

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
				475 using right-hand rule	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page	Volume Two Investigation Manual Page
PhysHS.05.o Physics	Electric and Magnetic Phenomena	Electric and magnetic phenomena are related and have many practical applications.	Students know how to apply the concepts of electrical and gravitational potential energy to solve problems involving conservation of energy.	190 conversions of energy 194 energy transformations 194 the law of conservation of energy 194 energy transformations 194 conservation of energy explained 195 conservation of energy in a closed system 195 applying conservation of energy for a marble rolling on a hilly track 196 energy transformation hydroelectric plant 196 energy transformation hydroelectric plant 197 conservation of energy for Hoover Dam 199 kinetic and potential energy conversions while bouncing in a trampoline 202 efficiency and energy conversions 203 efficiency and conservation of energy 205 efficiency in biological systems 206 connection between efficiency and time	66 law of conservation of energy 68 find the total energy at each position 72 potential to kinetic energy conversion in a pendulum 72 draw an energy flow diagram 74 investigating collisions and conservation of energy 88 potential to kinetic energy conversions of a pendulum

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				212	energy flow in a pendulum	
				212	energy conversion	
				213	the conversion process of energy flow	
				215	energy flows in biological systems	
				219	energy flow of a model solar car	
				227	kinetic energy conservation for elastic collisions	
				245	kinetic to potential energy changes in motion of an oscillator	
				253	oscillators exchange energy back and forth between potential and kinetic	
				256	resonant systems accumulate energy	
				277	waves propagate by exchanging energy between two forms	
				320	photosynthesis converts light energy to chemical energy	
				324	light from chemical reactions	

Correlation to California Science Content Standards

Foundations of Physics

Student Text and Investigation Manual

Standard #: Subject	Topic	Standard	Benchmark	Volume One Student Text Page		Volume Two Investigation Manual Page
				356	electromagnetic waves exchange energy between electricity and magnetic parts	
				370	relationship and conservation of mass and energy	
				393	conversion of energy in regenerative braking	
				400	energy conversions in a series circuit	
				451	MRI--energy exchange by a nucleus in a magnetic field	
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy	
				467	electric generators transform mechanical energy into electric energy	
				469	energy conservation and Faraday's law	
				515	thermodynamics and conservation of energy	
				552	conservation of energy in fluids	
				553	energy conservation and Bernoulli's equation	
				629	conservation of energy in nuclear reactions	