

Correlation to North Carolina Science Standards
Foundations of Physics
Student Text and Investigation Manual

Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
GEN01.1	Unifying Threads of Understanding	Nature of Science	Develop on understanding of science as a human endeavor, nature of science knowledge and historical perspectives.	7	in science inquiry is used to uncover truth	75	the discovery of atom's nucleus
				52	Dr. Harold Edgerton and strobe photography	122	research types of electromagnetic waves
				52	Dr. Harold Edgerton and strobe photography	147	Gilbert built the first electroscopes
				52	Dr. Harold Edgerton and strobe photography		
				91	biomechanics application		
				92	applications of biomechanics		
				112	impact of technology		
				155	first artificial human-made Earth satellite was Sputnik		
				178	Great Pyramid of Giza and simple machines		
				208	James Watt		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				269	wave motion and equilibrium		
				290	technological breakthrough of sound recording		

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				310	past theories of light		
				311	Thomas Edison and the electric light		
				314	Einstein and the speed of light		
				316	Albert Einstein		
				325	history of printing		
				348	the usefulness of recorded images		
				349	the telescope		
				361	Thomas Young		
				361	Young's double-slit experiment		
				366	Albert Einstein's theory of special relativity		
				367	Albert A. Michelson and Edward R. Morley		
				368	Einstein's thinking revolutionized physics		
				400	Gustav Robert Kirchhoff		
				440	scientists have never found single magnetic poles		
				440	magnetism		
				447	history of magnetism		
				447	discovering and using magnetism		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				456	Hans Christian Oersted		
				472	Dr. D. Bruce Montgomery		
				499	Albert Einstein		
				499	Democritus		
				499	development of atomic theory		
				501	search for elements and alchemy		
				501	ancient Greeks' ideas of elements		
				560	deep water submarine Alvin application		
				561	the Alvin research submarine		
				568	understanding how gravity works inside atoms		
				574	Niels Bohr		
				575	discovery of helium		
				575	Johann Balmer		
				578	Wolfgang Pauli		
				580	Max Planck and Albert Einstein		
				583	the meaning of the uncertainty principle		
				625	turning lead into gold		
				630	Wolfgang Pauli		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				637	areas of active research in physics		
				640	unresolved questions of history of universe		
				641	research on future of the universe		
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
GEN02.1	Unifying Threads of Understanding	Science as Inquiry	Develop the ability to do scientific inquiry and perform safe and appropriate manipulation of materials, equipment, and technologies.	543	featured throughout CPO Science program safety factors	79 129 131 150 159 160 176 176 185 192 206	safety note safety precautions safety precautions safety note safety note electromagnet safety safety note heat safety safety tip gas pressure safety note acid safety

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
GEN02.2	Unifying Threads of Understanding	Science as Inquiry	Develop a mastery of integrated process skills: acquiring, processing, and interpreting data; identifying variables and their relationships; designing investigations; experimenting; analyzing investigations; constructing hypotheses; formulating models.				
				2	data tables and graphs can be created on computer or graphing calculator	1	estimating length
				3	understanding natural laws	6	collecting data with precision
				3	inquiry starts with questions	6	accuracy and resolution and printing
				3	using life experiences and common sense	11	recognizing and controlling variables
				3	connecting cause and effect through observation	11	formulate a testable hypothesis
				4	inquiry through observation	12	cause and effect relationships
				7	revising explanations through observation	13	is there a trend in measurements?
				7	creating explanations through observation	13	create a graph
				8	forming hypotheses and testing with experiments	13	compare prediction to measurement
				8	refining theories based on observations	15	collect time data
				8	formulating a hypothesis	15	record data in a table
				9	connecting cause and effect through analysis	15	collect time data with precision
				9	testing ideas against scientific evidence	16	create a graph
				10	the usefulness of phlogiston theory despite being incorrect	16	describe the graph
						17	use a data table
						18	collect time data with precision
						18	record data
						21	conduct the experiment

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				10	putting forth ideas and then testing them	21	record results in table
				11	Ptolemy model vs. Copernicus model of the solar system	21	plan the experiment
						22	create graphs
				18	measuring distance	22	uniform acceleration model
				25	accuracy and precision of measurements	22	compare calculation with graph estimate
				25	why accuracy and precision are important	22	how do you measured positions compare to model?
				40	defining variables	24	create an algebraic model
				40	making a good model	25	find the average time
				42	control and experimental variables	27	record position and time data
				42	writing lab procedures	28	solve second law equation for string tension
				43	graphs are a way of representing data	29	does experiment agree with prediction?
				43	constructing a graph	29	record mass and force
				43	dependent and independent variables in graphs	32	develop a model that predicts acceleration
				44	using a graphical model to make a prediction and checking the model's accuracy	33	formulate a testable hypothesis
				44	graphical models	37	make a graph
				44	graphical models	38	make a graph
				45	recognizing patterns using graphs	43	create algebraic model

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				45	recognizing patterns and cause and effect relationships	43	follow the scientific method
				54	constructing a graph	43	write a procedure
				54	understanding patterns in relationships between variables	43	sketch four graphs
				54	importance of changing one variable at a time in an experiment	43	how does the measurement compare to your prediction?
				54	importance of changing one variable at a time in an experiment	43	perform experiment
				55	create a graph from a data table	43	measure and record the distance
				55	create a graph from a data table	43	test your prediction
				56	indicate relationships between variables in graphs	48	formulate a hypothesis
				56	indicate relationships between variables in graphs	49	write a formula
				60	creating the acceleration formula from experiments	56	create a graph
				60	creating the acceleration formula from experiments	58	find average of three trials
				66	developing the formulas for a model of motion with constant acceleration	60	measure input and output forces
				71	parachutes and air resistance	63	as mechanical advantage increases what happens to length of pulled string?
				142	finding x and y components of velocity for model rocket	65	form a hypothesis
				142	finding x and y components of velocity for model rocket	65	investigate motion on a roller coaster
				242	finding a basic cycle of harmonic motion	65	where does the marble move the fastest?
				246	understanding graphs of harmonic motion	66	record data in table

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				251	changing the natural frequency of a stretched rubber band	66	create a graph of speed vs. position
				282	write a formula relating velocity of wave to period and wavelength	66	what does the graph tell you?
				290	the process of digital sound reproduction	67	calculate average of three times
				297	frequency spectrum	67	measure vertical distance
				304	comparison of wave forms from guitar sounds	67	investigate motion on a roller coaster
				307	decibel level vs. frequency graph for human hearing	70	record data in table
				312	light intensity follows an inverse square law	71	calculate average work and power
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	76	compare predicted mass to actual mass
				411	the waveform of AC electricity	78	observe what happens
				412	average voltage and current of AC power	79	write a hypothesis
				423	charge by friction	82	design an experiment
				427	diagramming electric fields using field lines	82	analyze data
				432	making a simple capacitor	82	make three different graphs
				443	diagramming magnetic fields using magnetic field lines	82	record your data in table
						82	determine which variable has the greatest effect
						82	measure the length of the string

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				456	an experiment with a wire and compass	82	plan three experiments to determine which variable affects the period of a pendulum
				463	building an electromagnet with wire and a nail	82	create data table for self-designed experiment
				467	experiment demonstrating electromagnetic induction	82	dependent and independent variables
				479	current vs.voltage graph for a transistor	85	select appropriate technology to make measurements
				498	listing different types of matter in your home	87	sketch a graph
						87	observe what happens to the motion
						89	what is it that moves in the case of a wave?
						89	observe the wave pulse
						90	what effect does changing the tension have?
						94	give an equation that describes your observations
						111	do your observations support this hypothesis?
						114	are there differences between your prediction and measurement?
						129	choose circuit parts to light a bulb

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
						133	did battery voltage change?
						135	graph voltage vs. current
						136	graph voltage vs. current
						147	how did A and B tapes acquire different charge?
						151	make a graph of voltage vs. time
						160	create a graph
						166	variables that affect the performance of the generator
						167	make a graph of voltage vs. number of magnets
						169	make a current vs. voltage graph for the diode
						189	Bernoulli's equation
						201	design a procedure to separate a mixture
						201	develop a procedure
						202	identify two sources of experimental error
						204	build models of Na and Cl and use them to explain bonding
						206	record your observations

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GEN03.1	Unifying Threads of Understanding	Science and Technology	Develop on understanding of technology, the ability to perform technological design, and on understanding of the connection between science and technology.	12	all technology is based on fundamental laws of physics	83	design and construct a pendulum
				12	engineers design practical devices for solving problems	85	create a system that oscillates
				31	use of nanotechnology	163	design and test different electric motors
				31	use of nanotechnology	163	propose solutions that will work for each disk
				51	analyzing motion with video and strobe photography	163	apply steps of the design cycle to building different electric motors
				72	antilock brakes application	164	evaluate the performance of motor designs
				72	antilock brakes application		
				112	relationship between science and engineering and technology	167	suggest improvements you could make to the generator design
				112	designing a bridge	173	designing and building logic circuits
				113	conceptual design for a bridge	191	build an air-speed tester
				113	the engineering design cycle		
				113	build and test a prototype structure out of toothpicks		
				113	test and evaluate the prototype structure design		
				138	use of robots		
				155	geostationary satellites		
				172	bicycle physics application		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				196	hydroelectric power application		
				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		
				235	jet engines application		
				243	oscillators are used in communications and music and clocks		
				257	quartz crystals application		
				257	quartz crystals application		
				263	waves can carry information		
				280	microwave ovens application		
				280	microwave ovens application		
				293	uses of Doppler radar		
				311	invention of electric light		
				325	the printing press		
				325	the printing press		
				349	the telescope		

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				369	technological advances have allowed discovery of the expanding universe		
				372	holography application		
				378	importance of electricity		
				389	electrical devices are designed to operate at a certain voltage		
				392	hybrid gas/electric cars application		
				392	hybrid gas/electric cars application		
				413	wiring application		
				413	wiring application		
				429	electron beam accelerators		
				434	how television works application		
				434	how television works application		
				451	MRI application		
				451	MRI application		
				472	maglev train application		
				473	how magplanes levitate		
				490	why computers are useful		
				492	computers and electronic addition of numbers application		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				516	refrigerator application		
				534	energy-efficient building application		
				534	energy-efficient building application		
				543	failure analysis in the design process		
				543	evaluate three designs for a bridge		
				560	deep water submarine Alvin application		
				585	laser application		
				615	smoke detectors		
				623	creation of CAT scans		
				623	creation of CAT scans		
				631	nuclear power application		
				631	nuclear power application		

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GEN04.1	Unifying Threads of Understanding	Science Personal and Social Perspectives	Develop on understanding of personal and community health; population growth; natural and human induced hazards; science and technology in local, national and global challenges; careers in science and technology.	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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P01.01 9-12	Physics Content	The learner will build an understanding of linear motion.	Analyze velocity as a rate of change of position: average velocity and instantaneous velocity.	47	position vs. time graph	16	create a position vs. time graph
				48	determining speed from the slope of a position vs. time graph	22	create a position vs. time graph
				55	analyzing distance vs. time graph		
				61	zero acceleration vs. constant acceleration vs. acceleration with zero speed		
				128	constant velocity of horizontal component of projectile motion		
				130	analyzing changing velocity in vertical component of projectile motion		
				260	position vs. time graph of harmonic motion		

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P01.02 9-12	Physics Content	The learner will build an understanding of linear motion.	Compare and contrast speed and velocity as scalar and vector quantities.	37	how to calculate speed	9	collect data and calculate speed of car
				38	compare and contrast speed and velocity	10	make object move with speed of 1 m/sec
				48	determining speed from the slope of a position vs. time graph	12	finding speed of ball with one photogate
				55	calculate the average speed and distance traveled	14	find the speed of the ball
				64	calculate speed in accelerated motion	15	find speed of the ball
				64	calculate speed in accelerated motion	17	find the acceleration
				67	calculate time and distance from acceleration	17	find two speeds
				75	calculations of speed	21	calculate speed of ball
				118	vectors have magnitude and direction	25	derive acceleration equation
				119	displacement vectors	26	make ball roll at constant speed
				124	definition of the velocity vector	29	calculate the acceleration
				125	the velocity vector	33	calculate the predicted speed
				125	speed is the magnitude of the velocity vector	39	investigating vectors
				126	components of the velocity vector	42	find initial speed of ball
				127	adding velocity vectors	43	calculate the velocity vector
				146	calculating linear speed of a moving wheel	50	calculate the speed of the ball
						66	find the speed of the ball
						68	what is speed of the ball?

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				147	the linear speed of a rolling wheel	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
P01.03 9-12	Physics Content	The learner will build an understanding of linear motion.	Analyze graphs to describe instantaneous velocity as motion at a point in time.	47	position vs. time graph	13	graph speed versus position
				48	graphs showing changes in speed	16	create a position vs. time graph
				48	determining speed from the slope of a position vs. time graph	22	create a position vs. time graph
				50	graphs for motion of increasing speed and decreasing speed		
				55	analyzing distance vs. time graph		
				61	constant speed and constant acceleration		
				63	calculating acceleration from a speed vs. time graph		
				74	sketching speed vs. time graphs for different changes of motion		
				76	analyzing graph for changes in motion		
				260	position vs. time graph of harmonic motion		

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P01.04 9-12	Physics Content	The learner will build an understanding of linear motion.	Analyze acceleration as rate of change in velocity.	49	speed vs. time graph for constant speed	16	create a speed vs. time graph
				50	speed vs. time graph for downhill motion	17	learn techniques for finding acceleration
				54	graphing speed vs. time	17	find the acceleration
				58	acceleration is the rate of change in the speed of an object	17	studying acceleration
				59	comparing speed and acceleration	19	make a speed vs. time graph
				60	formula for acceleration	20	speed vs. time graph for uniform acceleration
				60	calculating acceleration from experiments	20	understanding equation for uniform accelerated motion
				61	general definition of acceleration	22	create a speed vs. time graph
				61	zero acceleration vs. constant acceleration vs. acceleration with zero speed	25	derive acceleration equation
				62	acceleration is total change of speed divided by total change in time	29	calculate the acceleration
				62	speed vs. time graph for accelerated motion		
				63	complex speed vs. time graphs		
				64	calculate speed in accelerated motion		

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				64	calculating the speed of an object that is accelerating		
				65	calculating distance from speed vs. time graph		
				67	calculate time and distance from acceleration		
				70	calculating height and time of flight in free fall problems		
				74	describing motion with speed vs. time graph		
				84	direction of net force and acceleration and speed		
				103	calculate the acceleration of a car including friction		
				128	constant velocity of horizontal component of projectile motion		
				129	analyze a horizontally launched projectile		
				130	analyzing changing velocity in vertical component of projectile motion		
				142	calculating acceleration for sled on slope		
				150	centripetal acceleration		

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				150	calculate the centripetal acceleration of a motorcycle		
				260	velocity vs. time graph of harmonic motion		

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P01.05 9-12	Physics Content	The learner will build an understanding of linear motion.	Analyze graphically and mathematically the relationships among position, velocity, acceleration, and time.	47	position vs. time graph	13	graph speed versus position
				48	determining speed from the slope of a position vs. time graph	16	create a speed vs. time graph
				48	graphs showing changes in speed	16	create a position vs. time graph
				49	speed vs. time graph for constant speed	19	make a speed vs. time graph
				50	graphs for motion of increasing speed and decreasing speed	20	speed vs. time graph for uniform acceleration
				50	speed vs. time graph for downhill motion	22	create a speed vs. time graph
				54	graphing speed vs. time	22	create a position vs. time graph
				55	analyzing distance vs. time graph		
				61	constant speed and constant acceleration		
				62	speed vs. time graph for accelerated motion		
				63	complex speed vs. time graphs		
				63	calculating acceleration from a speed vs. time graph		
				65	calculating distance from speed vs. time graph		
				74	sketching speed vs. time graphs for different changes of motion		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				74	describing motion with speed vs. time graph		
				76	analyzing graph for changes in motion		
				260	velocity vs. time graph of harmonic motion		
				260	position vs. time graph of harmonic motion		

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P02.01 9-12	Physics Content	The learner will build an understanding of two-dimensional motion.	Evaluate the measurement of two-dimensional motion (projectile and circular) in a defined frame of reference.	68	free fall and acceleration due to gravity	23	investigate the effect of gravity
				69	motion formulas for free fall	46	investigating angular speed
				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		

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				144	rotation and revolution and angular speed		
				145	calculating angular speed in radians per second		
				146	angular speed of a moving wheel		
				152	law of universal gravitation and orbital motion		
				154	satellites and orbital motion		
				154	orbits and gravitational force		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				155	satellite motion application		
				156	HEO and geostationary orbit		
				158	compare projectile motion to orbital motion		
				160	translation and rotation		
				165	the motion of a tossed object		
				166	centers of mass and gravity may differ		
				187	work done against gravity		

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				191	potential energy comes from gravity		
				243	orbit is a type of cycle		
P02.02 9-12	Physics Content	The learner will build an understanding of two-dimensional motion.	Assess the two-dimensional motion of objects by using their component vectors.	119	adding vectors	41	calculate the resultant vector
				120	adding vectors	45	calculate force components
				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	interpreting the x-y components of force		
				133	calculating components of a force vector		

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P02.03 9-12	Physics Content	The learner will build an understanding of two-dimensional motion.	Assess the independence of the horizontal and vertical vector components of projectile motion.	68	free fall and acceleration due to gravity	23	investigate the effect of gravity
				69	motion formulas for free fall	45	calculate force components
				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		
				122	calculating vector components		
				123	finding magnitude and angle of a vector		
				124	projectiles and trajectories		
				125	the velocity vector		
				126	components of the velocity vector		
				128	gravity only accelerates vertical motion		
				128	independence of horizontal and vertical motion in a velocity vector		
				129	vertical motion of a projectile		

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				130	projectiles launched at an angle		
				130	calculating velocity components of initial velocity		
				131	range of projectiles		
				132	interpreting the x-y components of force		
				133	calculating components of a force vector		
				134	resolving force of gravity in ramp coordinates		
				135	acceleration down an inclined plane		
				141	effects of gravity on motion of a projectile		
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				166	centers of mass and gravity may differ		
				187	work done against gravity		
				191	potential energy comes from gravity		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P02.04 9-12	Physics Content	The learner will build an understanding of two-dimensional motion.	Analyze and evaluate uniform circular motion.	144	rotation and revolution and angular speed	46	contrasting linear and angular motion
				145	calculating angular speed in radians per second	46	investigating angular speed
				146	the relationship between linear and angular speed	49	investigating centripetal force
				146	angular speed of a moving wheel		
				147	speedometers and odometers		
				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		
				460	orbital motion of a charge		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P03.01 9-12	Physics Content	The learner will develop an understanding of forces.	Assess, measure and calculate the conditions required to maintain a body in a state of static equilibrium.	83	finding the net force	30	Newton's third law and free body diagrams
				84	calculating net force	31	draw free body diagrams and identify action-reaction pairs
				86	zero acceleration means net zero force	45	balancing a specified force
				89	solving problems with action-reaction forces		
				103	net force includes the force of friction		
				106	net force must be zero in equilibrium		
				107	forces on a free-body diagram		
				107	net force of zero and free-body diagram		
				112	analysis of forces on a bridge		
				135	normal force of an inclined plane		
				141	calculate the net force		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P03.02 9-12	Physics Content	The learner will develop an understanding of forces.	Assess, measure and calculate the nature and magnitude of gravitational forces (Newton's Law of 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		
				158	calculate weight and acceleration due to gravity on Pluto		
				216	tides are due to force of gravity		
				642	Newton's laws and gravity		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P03.03 9-12	Physics Content	The learner will develop an understanding of forces.	Assess, measure and calculate the nature and magnitude of frictional forces.	41	effect of friction on motion of a ball on a ramp	34	investigate static and sliding friction
				71	air resistance and terminal speed	61	what effect does friction have on mechanical advantage?
				72	friction and traction and antilock brakes	67	friction as a source of energy dissipation
				100	the force of friction and the different types of friction		
				101	a model for friction		
				102	calculating the force of friction		
				103	friction and motion		
				104	reducing friction force		
				105	friction applications		
				115	friction of a pulled sled		
				124	effects of friction on trajectories		
				135	frictional force on an inclined plane		
				136	calculating acceleration on a ramp accounting for friction		
				142	effects of friction on acceleration		
				183	friction and mechanical advantage of wheel and axle		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				184	friction and mechanical advantage of ramps and screws		
				195	friction can divert some energy		
				203	how friction affects machines		
				206	friction and the arrow of time		
				216	tidal energy represents frictional energy from the Earth-moon system		
				245	friction causes damping in oscillators		
				245	friction causes damping in oscillators		
				256	friction and steady state		
P03.04 9-12	Physics Content	The learner will develop an understanding of forces.	Analyze and evaluate the nature of centripetal forces.	149	calculating centripetal force	49	investigating 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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P04.01 9-12	Physics Content	The learner will develop an understanding of Newton's Laws of Motion.	Determine that an object will continue in its state of motion unless acted upon by a net outside force (Newton's 1st Law of Motion, the Law of Inertia).	26	inertia is an effect of mass	26	study Newton's first law
				61	any acceleration must come from a force	27	collect data on Newton's first law
				78	changes in motion only occur through force	27	explain how Newton's first law applies
				79	all objects tend to resist changes in motion	85	where is the mass that provides inertia?
				79	descriptions of inertia and Newton's first law		
				85	if there is acceleration there must be force		
				87	forces always come in pairs		
				94	seat belt problem		
				94	inertia problem		
				148	direction of force determines linear or rotational motion		
				151	centrifugal force is actually an example of inertia		
				168	Newton's first law and rotational inertia		
				222	Newton's first law and momentum		
				249	inertia and restoring force cause harmonic motion		
				642	inertial mass		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P04.02 9-12	Physics Content	The learner will develop an understanding of Newton's Laws of Motion.	Assess, measure, and calculate the relationship among the force acting on a body, the mass of the body, and the nature of the acceleration produced (Newton's 2nd Law of Motion)	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	finding force from acceleration		
				85	force problems		
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P04.03 9-12	Physics Content	The learner will develop an understanding of Newton's Laws of Motion.	Analyze and mathematically describe forces as interactions between bodies (Newton's 3rd Law of Motion)	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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P05.01 9-12	Physics Content	The learner will develop an understanding of the nature of mechanical energy.	Analyze energy of position: gravitational potential energy and elastic potential energy.	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	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P05.02 9-12	Physics Content	The learner will develop an understanding of the nature of mechanical energy.	Analyze energy of motion, kinetic energy.	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		
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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P05.03 9-12	Physics Content	The learner will develop an understanding of the nature of mechanical energy.	Analyze, evaluate, and apply the principle of conservation of mechanical energy.	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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				553	energy conservation and Bernoulli's equation		
				629	conservation of energy in nuclear reactions		
P05.04 9-12	Physics Content	The learner will develop an understanding of the nature of mechanical energy.	Analyze and measure the transfer of mechanical energy through work.	185	work and energy	64	relationship between work and energy
				188	for all machines work out cannot exceed work in	64	compare output and input work
				189	relationship between work and energy		
				191	the symmetry between work and energy		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P06.01 9-12	Physics Content	The learner will build an understanding of impulse and momentum.	Assess the vector nature of momentum and its relation to the mass and velocity of an object.	222	comparison of kinetic energy and momentum	73	momentum is a vector
				223	momentum is a vector	78	which ball had a greater change in momentum?
				224	law of conservation of momentum	80	angular momentum behaves like a vector
				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		
				237	why is momentum a vector		
				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	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P06.02 9-12	Physics Content	The learner will build an understanding of impulse and momentum.	Compare and contrast impulse and momentum.	168	rotational inertia and mass distribution	57	investigating rotational inertia
				169	rotational inertia	73	momentum is a vector
				170	moment of inertia	78	which ball had a greater change in momentum?
				222	comparison of kinetic energy and momentum	79	investigate angular momentum
				223	momentum is a vector	80	explain life application of conservation of momentum
				224	law of conservation of momentum	80	angular momentum behaves like a vector
				225	conservation of momentum in collisions		
				226	applying conservation of momentum		
				227	momentum conservation for collisions in two and three dimensions		
				230	impulse formula		
				231	conservation of angular momentum examples		
				231	what is angular momentum		
				232	conservation of angular momentum		
				232	angular momentum depends on speed and mass and shape		
				233	formula for angular momentum		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				233	moment of inertia examples		
				235	jet engines work because of conservation of momentum		
				237	why is momentum a vector		
				238	difference between impact and impulse		
				370	Einstein's thinking about momentum of particles moving near the speed of light		
				629	conservation of momentum in nuclear reactions		
P06.03 9-12	Physics Content	The learner will build an understanding of impulse and momentum.	Analyze the factors required to produce a change in momentum.	222	comparison of kinetic energy and momentum	73	momentum is a vector
				223	momentum is a vector	79	investigate angular momentum
				231	what is angular momentum	80	explain life application of conservation of momentum
				232	angular momentum depends on speed and mass and shape	80	angular momentum behaves like a vector
				233	formula for angular momentum		
				237	why is momentum a vector		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P06.04 9-12	Physics Content	The learner will build an understanding of impulse and momentum.	Analyze interactions between objects and recognize the total momentum is conserved in both collision and recoil situations.	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	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P06.05 9-12	Physics Content	The learner will build an understanding of impulse and momentum.	Assess real world applications of the impulse and momentum including but not limited to sports and transportation.	223	momentum formula and calculating momentum	73	calculating momentum
				226	solving elastic and inelastic collision problems	75	investigate collisions and conservation of momentum
				229	force on a rocket from change in momentum	77	the momentum form of Newton's second law
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P07.01 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Analyze the relationship among the characteristics of waves: wavelength, frequency, period, and amplitude.	242	what is a cycle?	81	investigate the motion of a pendulum
				244	concepts of period and frequency explained	88	if frequency is increased what happens to total energy?
				245	concept of amplitude explained	89	study characteristics of a wave pulse on a string
				249	analyze the motion of the cycle of a pendulum	90	measure speed of a wave pulse
				251	systems tends to have a preferred frequency	90	study the speed of the wave pulse
				258	identify period and frequency and cycle and amplitude	93	investigate frequency and wavelength
				260	calculate speed of an oscillator	94	investigate the wavelength of standing waves
				264	basic properties of frequency and wavelength and amplitude	94	investigate the frequency of standing waves
				264	frequency and amplitude and wavelength in waves	124	use a spectrometer to measure wavelength of different colors of light
				265	concept of speed of a wave	125	study the polarization of a transverse spring wave
				266	speed of a wave is the speed at which a cycle moves		
				266	formula for speed of a wave		
				268	creating plane waves and circular waves		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				277	energy of a wave is proportional to frequency and amplitude		
				278	wavelength of a standing wave		
				282	describe relationship between wave characteristics		
				286	properties of sound waves		
				287	frequency and pitch of sound		
				288	relationship of loudness and amplitude and pressure in sound wave		
				291	pressure and amplitude of sound waves		
				292	importance of wavelength of sound waves		
				292	frequency and wavelengths of sound		
				300	pitch and frequency in music		
				303	design of a guitar		
				308	wave amplitude and harmonics of tuning fork and musical instrument		
				357	relationship between frequency and energy and color of light		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				375	relate color to frequency for visible light		
				452	MRI--each nucleus is a resonant oscillator		
P07.02 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Describe the behavior of waves in various media.	265	speed of a wave vs. speed of its medium		
				269	propagation of waves through continuous materials		
				284	which direction does a cork move on a water wave?		
				286	sound waves require matter to traverse		
				294	speed of sound in different materials		
				530	electromagnetic radiation		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P07.03 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Analyze the behavior of waves at boundaries between media: reflection and refraction.	270	waves and reflection	92	observing reflection in water waves
				270	waves and refraction	92	investigate reflection in a ripple tank
				270	concept of boundaries		
				271	waves and reflection and boundaries	106	study refraction in a prism
				271	curved boundaries	106	study reflection in a prism
				271	waves and refraction and boundaries	113	study how refraction works
				274	resonance and reflection	114	study the critical angle of refraction in a prism
				310	how we see	114	study index of refraction
				315	light rays bounce off a surface		
				315	light bends as it moves into a material		
				317	how the human eye sees color		
				318	how we perceive color		
				319	we see mostly reflected light		
				324	the process of how light is reflected		
				324	the process of how light is reflected		
				332	specular and diffuse reflection		
				333	finding the normal line for reflection		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				334	refraction is the bending of light rays		
				334	the index of refraction		
				335	refraction depends on index of refraction in both materials		
				336	total internal reflection and the critical angle		
				339	the image formed in a mirror		
				340	design of a lens		
				353	explain index of refraction		
				356	electromagnetic waves are oscillations of an energy field		
				358	index of refraction is ratio of speed of light in material to speed of light in vacuum		
P07.04 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Analyze the diffraction of waves.	270	waves and diffraction	92	investigate diffraction in a ripple tank
				272	waves and diffraction and boundaries	123	study light diffraction patterns
				345	diffraction spot size image defect		
				362	diffraction grating		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P07.05 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Analyze the relationship between the phenomena of interference and the principle of superposition.	273	concept of the superposition principle	101	investigate interference with sound waves
				273	sound and light waves and interference	123	study light interference
				273	constructive and destructive interference		
				278	nodes and antinodes		
				283	analyze superimposed waves		
				284	superimpose two waves		
				287	the superposition of sound waves		
				295	standing wave patterns of sound		
				296	interference of sound waves		
				297	Fourier's theorem and superposition principle and frequency spectrum		
				301	consonance and dissonance and beats		
				306	beats in a musical sound		
				307	applying superposition principle		
				361	interference of light waves and Young's double-slit experiment		
				373	holograms and the interference of light		

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P07.06 9-12	Physics Content	The learner will develop an understanding of wave motion and the wave nature of sound and light.	Analyze the frequency and wavelength of sound produced by a moving source (the Doppler effect).	293	definition of the Doppler effect		
				294	Doppler effect and supersonic and subsonic motion		
				307	understanding of Doppler effect		
				638	Doppler effect and red shift		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P08.01 9-12	Physics Content	The learner will build an understanding of basic elementary principles of thermodynamics.	Analyze the relationship among temperature, internal energy, and the random motion of atoms, molecules, and ions.	504	temperature scales and Fahrenheit-Celsius conversions	176	investigate temperature and its effect on materials
				505	measuring temperature	178	explore the connection between temperature and heat and energy
				506	temperature measures average kinetic energy	179	specific heat
				507	the Kelvin scale and converting between Kelvin and Celsius		
				509	temperature change and thermal energy		
				512	temperature and thermal energy and heat		
				513	transfer of thermal energy		
				513	definition of calorie		
				513	balance of thermal energy		
				514	specific heat and the heat equation		
				514	the heat equation		
				516	refrigerator application		
				517	air conditioners		
				519	understanding Fahrenheit and Celsius and Kelvin		
				520	relationship between temp and average kinetic energy		
				522	thermal equilibrium		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				523	thermal conductors and insulators		
				533	using Kelvin for radiation calculations		
				535	sources of heat transfer in buildings		
				537	heat flow between objects of different temperature		
				558	using temperature in Kelvins for Charles' law		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P08.02 9-12	Physics Content	The learner will build an understanding of basic elementary principles of thermodynamics.	Asses the conservation of energy using the First Law of Thermodynamics.	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		

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				553	energy conservation and Bernoulli's equation		
				629	conservation of energy in nuclear reactions		
P08.03 9-12	Physics Content	The learner will build an understanding of basic elementary principles of thermodynamics.	Analyze the 2nd law of thermodynamics: Heat will not flow spontaneously from a cold to a hot body, it is impossible to build a machine that does nothing but convert heat into useful work.	188	for all machines work out cannot exceed work in	64	compare output and input work
				195	frictional energy converted to heat		
				203	friction converts input work to heat		
				509	temperature change and thermal energy		
				513	transfer of thermal energy		
				513	balance of thermal energy		
				516	refrigerator application		
				522	thermal equilibrium		
				523	thermal conductors and insulators		
				535	sources of heat transfer in buildings		
				537	heat flow between objects of different temperature		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P09.01 9-12	Physics Content	The learner will build an understanding of static electricity.	Assess the inverse square relationship among force, charge, and distance in Coulomb's law.	419	differences between electric force and gravity	148	investigate Coulomb's law
				424	the strength of electric forces		
				424	Coulomb's law		
				425	calculate force using Coulomb's law		
				426	gravity is far weaker than electric forces		
				428	comparison between electric fields and gravitational fields		
				437	Coulomb's law is an inverse square law		
				438	calculating charge using Coulomb's law		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P09.02 9-12	Physics Content	The learner will build an understanding of static electricity.	Analyze the nature of electrical charges and the conservation of electric charge.	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	negative charges move in a conductor		
				421	current is the flow of charge		
				422	atomic structures of conductors and insulators and semiconductors		
				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		
				429	using a conductor as shielding from electric fields		
				430	a capacitor stores charge		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				433	ability of a capacitor to store charge is capacitance		
				453	magnetic poles and electric charge		
				480	conductivity and semiconductors		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P09.03 9-12	Physics Content	The learner will build an understanding of static electricity.	Analyze the relationship between moving electric charges and magnetic fields.	435	steering the electron beam on television screen	159	build an electromagnet
				456	magnetic field of a wire	160	find out what happens to strength of electromagnet when current is increased
				457	force on a current in a magnetic field	160	what happens to the strength of an electromagnet when you increase the current?
				457	right-hand rule		
				458	coils and solenoids		
				459	the magnetic field of coils and permanent magnets	160	study the right-hand rule
				461	calculate magnetic field at the center of a coil		
				462	electromagnets		
				462	coils used in electromagnets		
				462	finding the poles of an electromagnet using right-hand rule		
				463	building an electromagnet		
				463	adding turns increases an electromagnet's strength		
				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		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				475	using right-hand rule		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P10.01 9-12	Physics Content	The learner will build an understanding of direct current electrical circuits.	Analyze and measure the relationship among potential difference, current, and resistance in a direct current circuit.	378	concept of electric current	129	construct simple electric circuits
				379	concept of a circuit	131	construct a simple circuit
				380	understanding simple circuit and its diagram	131	explore the concept of electric current
				382	current flows through wires and carries energy	132	explore the concept of voltage
				382	voltage measures differences in energy	134	study the relationship between resistance and current
				383	voltage and potential energy	134	apply the concept of electrical resistance
				383	voltage is a measure of electric potential energy	134	Ohm's law
				383	voltage is a measure of electric potential energy	135	derive Ohm's law from experiment
				384	battery uses chemical energy to produce electrical charge	136	use Ohm's law to calculate the resistance
				386	simple bulb and battery circuits to illustrate electrical resistance	138	determining total resistance in a series circuit
				386	concept of electrical resistance	138	apply Ohm's law to series circuits
				386	relationship between current and resistance	171	use Ohm's law to calculate the resistance of the transistor
				387	measuring resistance		
				388	Ohm's law		
				388	calculate the current flowing in a circuit		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				389	the resistance of electrical devices		
				390	resistance of conductors and insulators		
				391	resistors		
				395	knowing difference between types of resistors		
				396	calculation of voltage from resistance and current		
				399	adding resistance in a series circuit		
				399	calculating current in a series circuit using Ohm's law		
				403	using Ohm's law in parallel circuits		
				404	using Ohm's law for circuit analysis		
				407	calculate currents and voltages in a network circuit		
				408	voltage definition		
				408	resistance definition		
				408	current definition		
				416	calculating resistance in a circuit		
				416	using Ohm's law to calculate current		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
				421	current is the flow of charge		
				422	negative charge of electrons and current flow		
				431	voltage of a capacitor circuit		
				431	current into and out of capacitors		
				479	resistance of a transistor		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P10.02 9-12	Physics Content	The learner will build an understanding of direct current electrical circuits.	Analyze and measure the relationship among current, voltage, and resistance in series and parallel circuits.	398	parallel circuit defined	137	parallel circuit and Ohm's law
				398	series circuit defined	137	investigate series circuits
				399	current and resistance in a series circuit	138	build a parallel circuit
				400	voltage in a series circuit	139	compare series and parallel circuits
				401	parallel circuits	139	analyze parallel circuits
				402	advantages of parallel circuits over series circuits	140	build and analyze network circuits
				402	voltage and current in a parallel circuit		
				403	resistance in parallel circuits		
				405	voltage dividers		
				406	comparing series and parallel circuits		
				407	solving network circuits		
				407	solving network circuits		
				414	why parallel circuits are used in homes and buildings		
				414	why series circuits are not used in homes and buildings		
				415	compare current in a series and parallel circuit		

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Standard #: Level	Strand	Competency Goal	Objective	student text pg	detail	investigation pg	detail
P10.03 9-12	Physics Content	The learner will build an understanding of direct current electrical circuits.	Analyze and measure the nature of power in an electrical circuit.	409	formula for calculating power in electric circuits	143	find the power rating of home appliances
				411	definition of AC current	164	calculate the power consumed by the motor
				411	definition of DC current		
				412	calculating power for AC circuits using a power factor		
				466	AC motors		
				470	generators are source of alternating current		
				471	transformers only work with AC current		
				478	diodes and AC to DC adapters		
				478	diodes and AC to DC adapters		
				484	rectifier circuit converts AC electricity to DC		
				484	rectifier circuit converts AC electricity to DC		