Correlation to New York Learning Standards for Math, Science, and Technology

Foundations of Physics

Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC1.1 Analysis, Inquiry, and Design/ Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical formulations to represent their thinking.	7	in science inquiry is used to uncover truth	13	compare prediction to measurement
				7	developing models to explain observations	13	create a graph
				11	Ptolemy model vs. Copernicus model of the solar system	16	what do the results tell you?
				40	creating useful models	16	describe the graph
				40	making a good model	16	create a graph
				43	constructing a graph	18	are the accelerations different?
				44	graphical models	19	does the ball accelerate?
				44	using a graphical model to make a prediction and checking the model's accuracy	22	compare calculation with graph estimate
				54	constructing a graph	22	model for uniform accelerated motion
				55	create a graph from a data table	22	uniform acceleration model
				60	creating the acceleration formula from experiments	22	how do you measured positions compare to model?
				66	developing the formulas for a model of motion with constant acceleration	22	create graphs
				101	a model for friction	24	create an algebraic model
				102	a model for static friction	28	solve second law equation for string tension
				282	write a formula relating velocity of wave to period and wavelength	29	does experiment agree with prediction?
						32	develop a model that predicts acceleration
						37	make a graph

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				290	the process of digital sound reproduction	38	make a graph
				297	frequency spectrum	43	how does the measurement compare to your prediction?
				306	explain why hearing can be damaged by loud sounds	43	what would happen if...?
				312	light intensity follows an inverse square law	43	create algebraic model
				330	optics and optical instruments	43	sketch four graphs
				411	the waveform of AC electricity	49	write a formula
				492	the binary number system and its use in computers	56	create a graph
				560	deep water submarine Alvin application	58	explain why the angular acceleration is different
				644	proof of Einstein's theory of general relativity	66	create a graph of speed vs. position
				645	astronomers find black holes by what is around them	76	compare predicted mass to actual mass
						80	explain your observations
						82	make three different graphs
						87	explain how force applied causes the response
						87	sketch a graph
						90	explain why higher tension makes waves move faster
						92	explain how wind might cause big waves in water

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
						94	give an equation that describes your observations
						109	explain how the colored filters work
						114	are there differences between your prediction and measurement?
						132	what conclusions can you draw?
						133	analyze data and explain a rule
						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

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC1.2 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	hone ideas through reasoning, library research, and discussion with others, including experts.	306	explain why hearing can be damaged by loud sounds	10	calculate percent difference
				499	development of atomic theory	13	find percent error
						16	what do the results tell you?
						18	are the accelerations different?
						19	does the ball accelerate?
						37	calculate percent difference
						38	calculate percent difference
						43	what would happen if...?
						43	calculate percent difference
						58	explain why the angular acceleration is different
						75	the discovery of atom’s nucleus
						80	explain your observations
						83	calculate percent error
						87	explain how force applied causes the response
						90	explain why higher tension makes waves move faster
						92	explain how wind might cause big waves in water

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
						109	explain how the colored filters work
						122	research types of electromagnetic waves
						132	what conclusions can you draw?
						133	analyze data and explain a rule
						202	find percent composition
						208	calculating percent yield
1SIC1.3 Analysis, Inquiry, and Design/Scientifi c Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	work toward reconciling competing explanations; clarifying points of agreement and disagreement.	7	revising explanations through observation		
				8	refining theories based on observations		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC1.4 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	coordinate explanations at different levels of scale, points of focus, and degrees of complexity and specificity and recognize the need for such alternative representations of the natural world.	18	measurements of distance in units of length	2	practice length measurement
				19	description of length measured in English and metric systems	3	convert from inches to meters
				19	scientists use metric units	7	estimating mass
				20	how to convert units of measurement	9	make distance measurement
				21	conversions between area and volume units	18	measure the length
				24	time scales in physics	23	measure the distance
				25	accuracy and precision of measurements	26	find length in centimeters
				27	the range of masses of objects in the universe	28	interpret setup diagram
				27	measuring mass in kg and grams	34	measure the mass
				33	commonly used units for measuring mass	36	measure the mass
				34	converting length units between systems	36	measure the new position
				37	units for speed	62	measure string length
				43	graphs are a way of representing data	65	measure vertical distance
				45	recognizing patterns using graphs	68	convert grams to kilograms
				54	understanding patterns in relationships between variables	70	measure and mark height
						78	measure mass of ball
						78	make the string 70 cm long
						83	design and construct a pendulum
						85	create a system that oscillates

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				56	indicate relationships between variables in graphs	85	draw a sketch of your system
				58	units of acceleration	92	sketch the wave fronts
				60	understanding units of acceleration	163	propose solutions that will work for each disk
				82	unit of force is derived	163	design and test different electric motors
				110	units for spring constant	163	apply steps of the design cycle to building different electric motors
				113	the engineering design cycle	173	designing and building logic circuits
				113	build and test a prototype structure out of toothpicks	178	measure 100 grams of water
				113	conceptual design for a bridge	191	build an air-speed tester
				119	drawing displacement vector using a scale	192	find the mass of the bottle
				144	units of angular speed	202	find the mass
				186	units of work are joules		
				246	understanding graphs of harmonic motion		
				304	comparison of wave forms from guitar sounds		
				307	decibel level vs. frequency graph for human hearing		
				357	relative sizes of objects from atom to light wave to bee		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				427	diagramming electric fields using field lines		
				428	deriving units for measuring electric fields		
				443	diagramming magnetic fields using magnetic field lines		
				479	current vs.voltage graph for a transistor		
				499	scale and Brownian motion		
				543	failure analysis in the design process		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC2.1 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	devise ways of making observations to test proposed explanations.	4	inquiry through observation	11	recognizing and controlling variables
				7	creating explanations through observation	43	test your prediction
				8	forming hypotheses and testing with experiments	65	where does the marble move the fastest?
				10	putting forth ideas and then testing them	82	determine which variable has the greatest effect
				40	defining variables	82	dependent and independent variables
				42	control and experimental variables	82	design an experiment
				43	dependent and independent variables in graphs	111	do your observations support this hypothesis?
				54	importance of changing one variable at a time in an experiment	147	how did A and B tapes acquire different charge?
				251	changing the natural frequency of a stretched rubber band	166	variables that affect the performance of the generator
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	201	design a procedure to separate a mixture
				423	charge by friction		
				432	making a simple capacitor		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC2.2 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	refine their research ideas through library investigations, including electronic information retrieval and reviews of the literature, and through peer feedback obtained from review and discussion.	10	the usefulness of phlogiston theory despite being incorrect	43	perform experiment
				42	writing procedures in a lab notebook helps make sure your results are repeatable	65	investigate motion on a roller coaster
				71	parachutes and air resistance	67	investigate motion on a roller coaster
				242	finding a basic cycle of harmonic motion	122	communicate your findings
				456	an experiment with a wire and compass	122	present your findings
				463	building an electromagnet with wire and a nail	204	build models of Na and Cl and use them to explain bonding
				467	experiment demonstrating electromagnetic induction		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC2.3 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	develop and present proposals including formal hypotheses to test their explanations, i.e., they predict what should be observed under specified conditions if the explantion is true.	8	formulating a hypothesis	11	formulate a testable hypothesis
				9	testing ideas against scientific evidence	21	plan the experiment
				432	making a simple capacitor	33	formulate a testable hypothesis
						48	formulate a hypothesis
						65	form a hypothesis
						79	write a hypothesis
						82	plan three experiments to determine which variable affects the period of a pendulum
						82	design an experiment
						201	determine the equipment you will need
						201	design a procedure to separate a mixture

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SIC2.4 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	carry out their research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus and recording observations as necessary.	42	writing lab procedures	21	conduct the experiment
				242	finding a basic cycle of harmonic motion	28	set up the ultimate pulley
						43	write a procedure
				293	demonstrating the Doppler effect	43	perform experiment
				456	an experiment with a wire and compass	65	investigate motion on a roller coaster
				463	building an electromagnet with wire and a nail	65	studying motion of ball on loop track
						67	set up the straight track
				467	experiment demonstrating electromagnetic induction	67	investigate motion on a roller coaster
						85	select appropriate technology to make measurements
						85	design and test a way to increase natural frequency
						129	choose circuit parts to light a bulb
						201	develop a procedure
						202	conduct your experiment

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII1.1 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	formulate questions independently with the aid of references appropriate for guiding the search for explanations of everyday observations.	3	inquiry starts with questions	82	design an experiment
				10	the usefulness of phlogiston theory despite being incorrect	89	what is it that moves in the case of a wave?
				71	parachutes and air resistance	201	design a procedure to separate a mixture
				432	making a simple capacitor	204	build models of Na and Cl and use them to explain bonding

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII1.2 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.	7	in science inquiry is used to uncover truth	16	what do the results tell you?
				306	explain why hearing can be damaged by loud sounds	18	are the accelerations different?
						19	does the ball accelerate?
				560	deep water submarine Alvin application	43	what would happen if...?
				644	proof of Einstein's theory of general relativity	58	explain why the angular acceleration is different
				645	astronomers find black holes by what is around them	80	explain your observations
						87	explain how force applied causes the response
						90	explain why higher tension makes waves move faster
						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

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII1.3 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.	42	writing procedures in a lab notebook helps make sure your results are repeatable	122 122 175 202	communicate your findings present your findings display information you found for your element keep detailed notes as you work
1SII1.4 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	seek to clarify, to assess critically, and to reconcile with their own thinking the ideas presented by others, including peers, teachers, authors, and scientists.	8 8 136 367 369 375	Comparing a theory and a natural law testing hypotheses with experiments determining formula for acceleration on a ramp speed of light did not behave as expected for Michelson and Morley proof of time dilation explain Thomas Young's demonstration of the wave nature of light	111	how does what you observed support the quantum theory?

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII2.1 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information.	4	inquiry through observation	13	compare prediction to measurement
				7	creating explanations through observation	16	what do the results tell you?
				7	revising explanations through observation	18	are the accelerations different?
				8	forming hypotheses and testing with experiments	18	propose one way to increase acceleration
				8	refining theories based on observations	19	does the ball accelerate?
				10	putting forth ideas and then testing them	22	compare calculation with graph estimate
				11	Ptolemy model vs. Copernicus model of the solar system	22	how do you measured positions compare to model?
				40	making a good model	29	does experiment agree with prediction?
				44	using a graphical model to make a prediction and checking the model's accuracy	43	test your prediction
						43	what would happen if...?
				297	frequency spectrum	43	how does the measurement compare to your prediction?
				306	explain why hearing can be damaged by loud sounds	58	explain why the angular acceleration is different
				323	using glow-in-the-dark plastic to demonstrate photon energy levels	65	where does the marble move the fastest?
				423	charge by friction	76	compare predicted mass to actual mass
						80	explain your observations

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
						87	explain how force applied causes the response
						90	explain why higher tension makes waves move faster
						92	explain how wind might cause big waves in water
						109	explain how the colored filters work
						111	do your observations support this hypothesis?
						114	are there differences between your prediction and measurement?
						132	what conclusions can you draw?
						133	analyze data and explain a rule
						147	how did A and B tapes acquire different charge?
						202	would you modify your procedure further?

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII2.2 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.	2	understanding natural laws	1	estimating length
				3	connecting cause and effect through observation	6	collecting data with precision
				4	inquiry through observation	6	accuracy and resolution and printing
				7	creating explanations through observation	11	recognizing and controlling variables
				8	forming hypotheses and testing with experiments	12	cause and effect relationships
				9	connecting cause and effect through analysis	15	collect time data with precision
				10	putting forth ideas and then testing them	15	collect time data
				18	measuring distance	18	collect time data with precision
				25	accuracy and precision of measurements	21	plan the experiment
				40	defining variables	43	measure and record the distance
				42	control and experimental variables	43	test your prediction
				43	dependent and independent variables in graphs	60	measure input and output forces
				45	recognizing patterns and cause and effect relationships	65	where does the marble move the fastest?
				54	importance of changing one variable at a time in an experiment	67	measure vertical distance
						78	observe what happens
						82	determine which variable has the greatest effect
						82	measure the length of the string

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Standard #: Level Key Idea Performance Indicator Standard/Topi	student text pg	detail	investigation pg	detail
	251	changing the natural frequency of a stretched rubber band	82	design an experiment
	323	using glow-in-the-dark plastic to demonstrate photon energy levels	82	dependent and independent variables
	423	charge by friction	87	observe what happens to the motion
	432	making a simple capacitor	89	observe the wave pulse
	498	listing different types of matter in your home	90	what effect does changing the tension have?
			111	do your observations support this hypothesis?
			147	how did A and B tapes acquire different charge?
			166	variables that affect the performance of the generator
			201	determine the equipment you will need
			201	design a procedure to separate a mixture
			206	record your observations

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
1SII2.3 Analysis, Inquiry, and Design/Scientific Inquiry	Intermediate	Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	carry out their research proposals, recording observations and measurements (e.g., lab notes, audio tape, computer disk, video tape) to help assess the explanation.	18	measuring distance	1	estimating length
				25	accuracy and precision of measurements	6	collecting data with precision
				142	finding x and y components of velocity for model rocket	6	accuracy and resolution and printing
				242	finding a basic cycle of harmonic motion	15	collect time data with precision
				293	demonstrating the Doppler effect	15	record data in a table
				456	an experiment with a wire and compass	15	collect time data
				463	building an electromagnet with wire and a nail	17	use a data table
				467	experiment demonstrating electromagnetic induction	18	record data
				498	listing different types of matter in your home	18	collect time data with precision
						21	record results in table
						21	conduct the experiment
						27	record position and time data
						28	set up the ultimate pulley
						29	record mass and force
						43	perform experiment
						43	measure and record the distance
						60	measure input and output forces
						65	studying motion of ball on loop track

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
						65	investigate motion on a roller coaster
						66	record data in table
						67	set up the straight track
						67	measure vertical distance
						67	investigate motion on a roller coaster
						70	record data in table
						78	observe what happens
						82	measure the length of the string
						82	create data table for self-designed experiment
						82	record your data in table
						85	select appropriate technology to make measurements
						85	design and test a way to increase natural frequency
						87	observe what happens to the motion
						89	observe the wave pulse
						129	choose circuit parts to light a bulb
						202	conduct your experiment
						206	record your observations

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
4PSC4.1 Science/Physical Setting	Commencement	Energy exists in many forms, and when these forms change energy is conserved.	observe and describe transmission of various forms of energy.	189	energy appears in different forms	68	calculate potential and kinetic energy
				190	different forms of energy	72	potential to kinetic energy conversion in a pendulum
				191	the formula for potential energy	88	potential to kinetic energy conversions of a pendulum
				192	the formula for kinetic energy	95	waves carry energy from one place to another
				193	deriving the formula for kinetic energy	122	study properties of the electromagnetic spectrum
				194	energy transformations		
				196	energy transformation hydroelectric plant		
				199	trace the energy transformations from sun to a flashing taillight		
				199	kinetic and potential energy conversions while bouncing in a trampoline		
				204	efficiency of Earth		
				205	calories in food		
				210	energy from the sun drives the weather on Earth		
				212	energy flow in a pendulum		
				212	understand basic forms of energy		
				215	energy flows in biological systems		

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				245	kinetic to potential energy changes in motion of an oscillator		
				253	harmonic motion involves both potential and kinetic energy		
				253	oscillators exchange energy back and forth between potential and kinetic		
				262	waves transmit energy		
				263	waves are a form of traveling energy		
				272	waves transfer energy through absorption		
				277	energy of a wave		
				310	light is a form of energy		
				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	visible light has just the right energy for life		
				320	the energy of IR and UV light		
				322	photons are bundles of light energy		

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				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	description and examples of infrared waves		
				360	visible light waves		
				360	description and examples of ultraviolet waves		
				364	transmission of light through two polarizers		
				373	wave fronts of light		
				378	electrical energy		
				384	batteries use chemical energy		
				530	energy and radiation relationships		
				531	thermal radiation and infrared light		
				552	explanation of pressure and energy		
				597	the energy of chemical bonds is described		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				619	radiation as a flow of energy		
				622	energy of x-rays		
				624	UV light is ionizing radiation		
				625	energy changes in nuclear reactions		
				626	source of energy in nuclear reactions		
				627	fusion reactions and the sun		
				627	energy of fusion reactions		
				628	energy of fission reactions		
				647	energy from antimatter		
4PSC4.2 Science/Physical Setting	Commencement	Energy exists in many forms, and when these forms change energy is conserved.	explain heat in terms of kinetic molecular theory.	506	temperature and addition of heat energy		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
4PSC4.3 Science/Physical Setting	Commencement	Energy exists in many forms, and when these forms change energy is conserved.	explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g., molecules, electrons, and nuclear particles.	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	96	investigate range of frequencies the ear can detect
				281	microwaves	124	use a spectrometer to measure wavelength of different colors of light
				282	describe relationship between wave characteristics		
				287	how we hear sound waves		
				287	frequency and pitch of sound		
				288	loudness and decibels and the sensitivity of the ear		
				288	relationship of loudness and amplitude and pressure in sound wave		
				291	pressure and amplitude of sound waves		
				291	sound vibrates the eardrum		
				292	importance of wavelength of sound waves		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				292	frequency and wavelengths of sound		
				298	constructing meaning from sound		
				299	how the ear works		
				300	music and sound		
				300	pitch and frequency in music		
				357	relationship between frequency and energy and color of light		
				359	waves of the electromagnetic spectrum		
				375	relate color to frequency for visible light		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
4PSC4.4 Science/Physical Setting	Commencement	Energy exists in many forms, and when these forms change energy is conserved.	explain the uses and hazards of radioactivity.	502	elements past #92 are radioactive and decay	209	radioactive decay and half life
				570	use of radioactive isotopes in medicine	210	simulate radioactive decay
				570	radioactive isotopes	211	types of radiation
				573	fusion	213	fusion and fission
				573	nuclear reactions		
				614	radioactive decay		
				614	three kinds of radioactivity		
				615	alpha and beta and gamma radiation		
				616	energy and radioactivity		
				617	half-life		
				618	half-life calculation		
				620	ionizing and nonionizing radiation		
				620	danger of gamma rays and alpha particles		
				622	x-ray machines		
				623	CAT scans		
				624	measuring radiation with Geiger counter		
				624	danger of ionizing radiation		
				625	nuclear reactions		
				627	fusion reactions		

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

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
4PSC5.1 Science/Physical Setting	Commencement	Energy and matter interact through forces that result in changes in motion.	explain and predict different patterns of motion of objects (e.g., linear and angular motion, velocity and acceleration, momentum and inertia).	26	inertia is an effect of mass	9	collect data and calculate speed of car
				36	the precise meaning of speed	9	calculate speed of rolling marble
				37	how to calculate speed	10	make object move with speed of 1 m/sec
				37	calculating speed	12	finding speed of ball with one photogate
				38	compare and contrast speed and velocity	14	find the speed of the ball
				38	the speed formula and calculating speed	15	find speed of the ball
				41	effect of friction on motion of a ball on a ramp	16	create a position vs. time graph
				41	speed of a ball on a ramp	16	create a speed vs. time graph
				46	speed is the rate of change of position	17	find the acceleration
				47	average and instantaneous speed	17	find two speeds
				47	position vs. time graph	17	studying acceleration
				48	determining speed from the slope of a position vs. time graph	17	learn techniques for finding acceleration
				48	determining speed from the slope of a position vs. time graph	19	make a speed vs. time graph
				49	speed vs. time graph for constant speed	20	speed vs. time graph for uniform acceleration
				50	speed vs. time graph for downhill motion	20	understanding equation for uniform accelerated motion
				54	graphing speed vs. time	21	calculate speed of ball

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Standard #: Level Standard/Topi	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
			55	analyzing distance vs. time graph	22	create a position vs. time graph
			55	calculate the average speed and distance traveled	22	create a speed vs. time graph
			58	acceleration is the rate of change in the speed of an object	23	investigate the effect of gravity
			59	comparing speed and acceleration	25	derive acceleration equation
			60	formula for acceleration	26	make ball roll at constant speed
			60	calculating acceleration from experiments	26	study Newton's first law
			61	any acceleration must come from a force	27	collect data on Newton's first law
			61	zero acceleration vs. constant acceleration vs. acceleration with zero speed	27	explain how Newton's first law applies
			61	general definition of acceleration	27	were any forces acting on the ball?
			62	speed vs. time graph for accelerated motion	28	investigate Newton's second law
			62	acceleration is total change of speed divided by total change in time	29	calculate the acceleration
			63	complex speed vs. time graphs	30	investigate Newton's third law
			64	calculate speed in accelerated motion	30	Newton's third law and free body diagrams
					31	draw free body diagrams and identify action-reaction pairs
					33	calculate the predicted speed

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				64	calculating the speed of an object that is accelerating	34	investigate static and sliding friction
				64	calculate speed in accelerated motion	39	investigating vectors
				65	calculating distance from speed vs. time graph	42	find initial speed of ball
				67	calculate time and distance from acceleration	43	calculate the velocity vector
				68	free fall and acceleration due to gravity	45	balancing a specified force
				69	motion formulas for free fall	46	investigating angular speed
				70	solving problems with free fall	46	contrasting linear and angular motion
				70	calculating height and time of flight in free fall problems	49	consider forces acting on the ball
				71	air resistance and terminal speed	49	investigating centripetal force
				71	acceleration of gravity does not depend on mass	50	calculate the speed of the ball
				72	friction and traction and antilock brakes	57	investigating rotational inertia
				74	understanding average speed and instantaneous speed	58	rotational application of Newton's second law
				74	describing motion with speed vs. time graph	61	what effect does friction have on mechanical advantage?
				75	calculations of speed	66	find the speed of the ball
						68	what is speed of the ball?
						73	calculating momentum

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Standard #: Level Standard/Topi	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
			75	problem understanding acceleration due to gravity	73	momentum is a vector
			78	force is an action that can change motion	75	investigate collisions and conservation of momentum
			78	changes in motion only occur through force	76	calculate speeds of projectile and target balls
			79	what systems in a car overcome the law of inertia	77	the momentum form of Newton's second law
			79	all objects tend to resist changes in motion	77	relationship between force and motion and the second law
			79	descriptions of inertia and Newton's first law	78	which ball had a greater change in momentum?
			80	seat belts and air bags and Newton's first law	79	investigate angular momentum
			80	Newton's laws and cup holders	80	explain life application of conservation of momentum
			81	Newton's second law of motion	80	torque changes the direction of angular momentum vector
			81	force is related to acceleration	80	angular momentum behaves like a vector
			83	calculation using Newton's second law	85	where is the mass that provides inertia?
			83	finding the net force	90	calculate the speed of the wave pulse
			84	Newton's second law and dynamics problems	191	calculate speed of air in homemade air-speed tester
			84	direction of net force and acceleration and speed		
			84	calculating net force		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				85	finding force from acceleration		
				85	force problems		
				85	if there is acceleration there must be force		
				86	zero acceleration means net zero force		
				87	forces always come in pairs		
				87	explaining Newton's third law in terms of an astronaut moving through space		
				87	forces always occur in action-reaction pairs		
				88	explaining Newton's third law in terms of moving a skateboard		
				88	Newton's third law operates on pairs of objects		
				89	identifying which force is acting on which object		
				89	solving problems with action-reaction forces		
				90	examples of Newton's third law		
				93	problems using Newton's first law and second law		
				94	inertia problem		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				94	seat belt problem		
				97	strength of gravity on Earth and Jupiter		
				98	gravity and acceleration and weightlessness		
				99	balanced force problems		
				100	the force of friction and the different types of friction		
				100	friction is a force that resists motion		
				101	a model for friction		
				102	calculating the force of friction		
				102	the normal force as the reaction in an action-reaction pair		
				103	net force includes the force of friction		
				103	calculate the acceleration of a car including friction		
				103	friction and motion		
				104	reducing friction force		
				105	friction applications		
				106	net force must be zero in equilibrium		
				106	Newton's second law and net force		

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Student Text and Investigation Manual

Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				107	net force of zero and free-body diagram		
				107	forces on a free-body diagram		
				108	use equilibrium to find an unknown force		
				108	equilibrium and Newton's second law		
				111	understanding reaction forces in terms of springs and deformation		
				112	analysis of forces on a bridge		
				115	friction of a pulled sled		
				116	calculate the acceleration of a toy		
				118	vectors have magnitude and direction		
				119	displacement vectors		
				124	effects of friction on trajectories		
				124	projectiles and trajectories		
				124	definition of the velocity vector		
				125	the velocity vector		
				125	speed is the magnitude of the velocity vector		
				126	components of the velocity vector		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				127	adding velocity vectors		
				128	constant velocity of horizontal component of projectile motion		
				128	gravity only accelerates vertical motion		
				129	vertical motion of a projectile		
				129	analyze a horizontally launched projectile		
				130	analyzing changing velocity in vertical component of projectile motion		
				130	projectiles launched at an angle		
				131	range of projectiles		
				133	balancing forces in two dimensions		
				134	resolving force of gravity in ramp coordinates		
				135	normal force of an inclined plane		
				135	acceleration down an inclined plane		
				135	frictional force on an inclined plane		
				136	calculating acceleration on a ramp		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				136	calculating acceleration on a ramp accounting for friction		
				137	predicting motion in three dimensions and controlling force and acceleration in space missions		
				137	calculating acceleration from 3-D forces		
				137	the vector form of Newton's second law		
				139	determining position by triangulation and inertial navigation		
				141	calculate the net force		
				141	effects of gravity on motion of a projectile		
				142	calculating acceleration for sled on slope		
				142	effects of friction on acceleration		
				144	rotation and revolution and angular speed		
				145	calculating angular speed in radians per second		
				146	the relationship between linear and angular speed		
				146	angular speed of a moving wheel		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				146	calculating linear speed of a moving wheel		
				147	speedometers and odometers		
				147	the linear speed of a rolling wheel		
				148	direction of force determines linear or rotational motion		
				148	centripetal force causes circular motion		
				148	acceleration can be a change in the direction of motion		
				149	calculating centripetal force		
				149	calculating centripetal force		
				150	centripetal acceleration		
				150	using centripetal acceleration to create the feeling of gravity by rotating the space station		
				150	formula for centripetal acceleration		
				150	calculate the centripetal acceleration of a motorcycle		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				151	centrifugal force is actually an example of inertia		
				151	banked turns		
				152	law of universal gravitation and orbital motion		
				154	orbits and gravitational force		
				154	satellites and orbital motion		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				155	centripetal force and the law of universal gravitation combine to form the orbit equation		
				155	satellite motion application		
				155	satellite motion application		
				156	HEO and geostationary orbit		
				156	satellites in orbit		
				157	compare linear and angular speeds		
				158	calculating centripetal force		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				158	compare projectile motion to orbital motion		
				160	center of rotation		
				160	translation and rotation		
				165	the motion of a tossed object		
				166	centers of mass and gravity may differ		
				168	rotational inertia and mass distribution		
				168	Newton's first law and rotational inertia		
				169	rotational inertia		
				169	relationship between angular acceleration and linear acceleration		
				169	Newton's second law applies to rotational motion		
				170	moment of inertia		
				171	Newton's second law for rotational motion variables		
				171	angular acceleration of a wheel		
				171	rotational motion and linear motion		
				181	torque and mechanical advantage of a lever		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				183	friction and mechanical advantage of wheel and axle		
				183	mechanical advantage of gears		
				184	friction and mechanical advantage of ramps and screws		
				187	work done against gravity		
				191	potential energy comes from gravity		
				222	Newton's first law and momentum		
				222	comparison of kinetic energy and momentum		
				223	momentum is a vector		
				223	momentum formula and calculating momentum		
				224	law of conservation of momentum		
				224	momentum and Newton's third law		
				225	conservation of momentum in collisions		
				226	applying conservation of momentum		
				226	solving elastic and inelastic collision problems		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				227	momentum conservation for collisions in two and three dimensions		
				228	seat belts and air bags		
				228	Newton's second law relating force and momentum		
				229	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		
				231	conservation of angular momentum examples		
				231	linear and angular momentum		
				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		
				233	moment of inertia examples		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				234	torque resists change in angular momentum		
				234	gyroscopes and the space shuttle		
				235	jet engines work because of conservation of momentum		
				236	momentum conservation of turbofan engine		
				237	why is momentum a vector		
				238	cars that crumple in a collision		
				238	momentum in billiards		
				238	compare linear and angular momentum		
				239	calculate momentum		
				240	forces in a car stopping		
				243	orbit is a type of cycle		
				245	friction causes damping in oscillators		
				249	inertia and restoring force cause harmonic motion		
				252	Newton's second law and natural frequency		
				254	definition of periodic force		
				256	friction and steady state		

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Standard #: Standard/Topi	Level	Key Idea	Performance Indicator	student text pg	detail	investigation pg	detail
				260	velocity vs. time graph of harmonic motion		
				260	position vs. time graph of harmonic motion		
				276	natural frequency and harmonics		
				370	Einstein's thinking about momentum of particles moving near the speed of light		
				425	electric forces always occur in pairs according to Newton's third law		
				460	orbital motion of a charge		
				548	Newton's third law and pressure in a fluid		
				550	pressure and the third law		
				557	pressure of gases		
				629	conservation of momentum in nuclear reactions		
				642	inertial mass		
4PSC5.3 Science/Physical Setting	Commencement	Energy and matter interact through forces that result in changes in motion.	compare energy relationships within an atom's nucleus to those outside the nucleus.	568	forces in the atom		
				626	strong force and electromagnetic force in the nucleus		
				649	four forces in nature		