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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.A.1	5.1 Science Practices	185	efficiency and time moving forward	80	energy and quantum theory
	A. Understand Scientific Explanations	244	atomic theory	80	relate idea that electrons exist at set energy levels to quantum theory
	Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.	245	atomic structure models	81	spectral analysis and electron energy levels
		246	subatomic particles and charge	82	investigate concepts of radioactivity
		249	atomic number and mass number	83	radioactivity and the environment
		251	absorption and emission of light by atomic electrons	84	investigate frames of reference
				85	demonstrate two frames of reference
				86	consider that time passes at different rates in reference frames that are moving relative to each other
5.1.12.A.2					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.A.2	5.1 Science Practices	10	using models in science	6	create a graph of the car's speed vs. position
	A. Understand Scientific Explanations	19	mathematical descriptions	12	analyze the graphical models
	Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.	19	mathematical models	13	create a model for the velocity of energy car
		26	interpreting distance/time graph	22	create and analzye a second law of motion graph
		36	mathematical model of acceleration	38	create and test a graphical model
		38	motion graphs	39	create a graph of force vs. extension for the spring
		80	relating impulse and momentum conservation	53	design and test a solution to the lever mystery
		108	using a graph to find force vector components	59	graph work done vs. deflection of rubber band
		119	a model for friction	76	design and test a way to demonstrate heat transfer by radiation
		141	projectile motion problems	111	derive a formula to calculate the charge
		245	atomic structure models	120	making a model maglev train
		253	quantum model of the atom	121	design a maglev train model
		382	building your own compass (#3)	127	building different generators
		431	harmonic motion graphs		
		547	equation for the speed of light		
5.1.12.A.3					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.A.3	5.1 Science Practices	6	what is a variable	0	Each investigation begins with a Key Question
	A. Understand Scientific Explanations	8	control and experimental variables	0	computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation
	Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.	8	dependent variables	9	identify experimental and controlled variables
		8	independent variables	9	design a valid experiment by changing only one variable at a time
		24	importance of changing one variable at a time in an experiment	43	develop a hypothesis
				76	what is the best way to present your results?
				139	state a hypothesis about period of pendulum
				139	investigate variables and how they affect the period of a pendulum
5.1.12.B.1					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.B.1	5.1 Science Practices	4	what is an experiment	2	accuracy, resolution, and precision
	B. Generate Scientific Evidence Through Active Investigations	8	designing experiments	7	find percent error
	Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.	8	cause and effect relationships	11	using a velocity sensor and data collection system
		15	accuracy, precision, resolution	13	using a velocity sensor and data collection system
				16	collect data to calculate the car's acceleration
				21	investigate second law of motion
				31	investigate Newton's 3rd law of motion
				42	investigate sliding friction
				44	investigate projectile motion
				58	investigate concept of energy as stored work
				60	how close is your prediction to the actual measurement?
				64	design an experiment
				74	use a temperature sensor and data collecton system
				92	investigate conductors and insulators
				116	estimate the precision of measurements
				125	investigate electromagentic induction
				139	investigate variables and how they affect the period of a pendulum
				139	design pendulum experiments
				155	investigate sound wave interference
				184	investigate phosphorescence
5.1.12.B.2	5.1 Science Practices	9	scientific evidence and data tables		

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
	B. Generate Scientific Evidence Through Active Investigations	10	using models in science	0	computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation
	Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.	19	mathematical models	1	using and understanding photogates
		36	mathematical model of acceleration	12	analyze the graphical models
		119	a model for friction	13	create a model for the velocity of energy car
				21	use an electronic scale
				38	create and test a graphical model
				51	use a spring scale
				61	using a timer and photogates
				63	using a timer and photogates
				74	use a temperature sensor and data collecton system
				76	constraints for the thermal radiation demonstration model design
				80	model how atoms exchange energy
				95	use a multimeter to measure current
				96	use a multimeter to measure resistance of a pot
				97	use a multimeter to measure voltage drop
				101	use a multimeter to measure current
				109	build an electroscope and conduct experiments
				111	derive a formula to calculate the charge
				120	making a model maglev train
				121	compare and evaluate models

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
				123	build an electric motor and perform experiments
				125	use a timer and photogate to measure speed of rotor
				138	use a timer and photogate to measure the period of a pendulum
5.1.12.B.3	5.1 Science Practices	7	theories allow for predictions	6	predict the speed of the car
	B. Generate Scientific Evidence Through Active Investigations	62	you can predict that a downhill force must exist	6	how does prediction compare with measurement?
	Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.	63	you can predict the velocity after it is dropped	28	predicting maximum velocity through energy conservation law
		81	the law of conservation of momentum allows us to make accurate predictions	29	testing your predictions
		88	the law of conservation of energy can be used to predict the height of the ball	30	comparing predicted velocities to measured velocities
		158	predicting currents and eddies	37	predict the acceleration of the car on the ramp
		255	predicting the behavior of particles in a system	37	how did your measured acceleration compare with the prediction?
		284	general relativity predicts black holes	60	how close is your prediction to the actual measurement?
		305	use Ohm's law to predict the current	60	predict speed of car
				62	predict how many bounces the car will make
5.1.12.B.4					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.B.4	5.1 Science Practices	4	what is analysis	2	accuracy, resolution, and precision
	B. Generate Scientific Evidence Through Active Investigations	8	scientific method	7	find percent error
	Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.	11	communicating via measurement	16	collect data to calculate the car's acceleration
		11	importance of units	18	constant force data table
		15	accuracy, precision, resolution	43	create a data table for all measurements
		16	significant digits and metric ruler	49	find the average range of the launched marble
		22	scientific method in action	60	how close is your prediction to the actual measurement?
		25	converting length units between systems	107	find the average of the three times
		103	analyzing a nutrition label	116	estimate the precision of measurements
		314	analyze an appliance label	116	estimate the precision of measurements
5.1.12.C.1	5.1 Science Practices	9	scientific evidence and data tables	6	how does prediction compare with measurement?
	C. Reflect on Scientific Knowledge	196	the evidence supports the conclusion	30	comparing predicted velocities to measured velocities
	Reflect on and revise understandings as new evidence emerges.	244	draw a conclusion that supports the evidence	37	how did your measured acceleration compare with the prediction?
				186	explain how your observations support or refute the hypothesis
5.1.12.C.2					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.C.2	5.1 Science Practices	10	what is a model	6	create a graph of the car's speed vs. position
	C. Reflect on Scientific Knowledge	25	constructing a graph	6	how does prediction compare with measurement?
	Use data representations and new models to revise predictions and explanations.	38	motion graphs	12	analyze the graphical models
		40	motion graphs	22	create and analzye a second law of motion graph
		108	using a graph to find force vector components	30	comparing predicted velocities to measured velocities
		431	harmonic motion graphs	37	how did your measured acceleration compare with the prediction?
		432	finding the amplitude on a harmonic motion graph	39	create a graph of force vs. extension for the spring
		441	improving the Hancock tower design	59	graph work done vs. deflection of rubber band
		478	improving acoustics in a concert hall	60	graph speed vs. rubber band deflection
		512	improvements made possible by charge-coupled devices	62	make a graph of efficiency vs. speed
		537	improving retinal implants	76	evaluate the success of your heat transfer model
				83	construct a graph
				111	graph current vs. time for the capacitor
				121	compare and evaluate models
				126	graph voltage vs. speed
				126	what changes have the largest effect on voltage produced?
				127	evaluate the effects your design change produced
				127	measure voltage for each different generator
				139	sketch harmonic motion graphs
5.1.12.C.3					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.C.3	5.1 Science Practices	9	scientific evidence and data tables	76	evaluate the success of your heat transfer model
	C. Reflect on Scientific Knowledge	26	interpreting distance/time graph	93	draw and interpret circuit diagrams
	Consider alternative theories to interpret and evaluate evidence-based arguments.	244	draw a conclusion that supports the evidence	121	compare and evaluate models
				127	evaluate the effects your design change produced
5.1.12.D.1	5.1 Science Practices	11	communicating via measurement	0	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation
	D. Participate Productively in Science			102	explain what happened
	Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.			126	explain and communicate your findings
5.1.12.D.2	5.1 Science Practices	38	position vs. time graphs	14	create and study a velocity vs. time graph
	D. Participate Productively in Science	39	position vs. time graph for accelerating motion	17	create and study a velocity vs. time graph
	Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams.	40	speed vs. time graph	35	free body diagrams
		41	speed vs. time graph for accelerating motion	64	create an energy flow diagram
		43	finding distance from a speed vs. time graph	93	draw and interpret circuit diagrams
		296	circuit diagrams	139	understanding graphs of harmonic motion
		431	understanding graphs of harmonic motion	169	construct ray diagrams
		523	drawing a ray diagram	170	construct ray diagrams
		529	ray diagram of an image in a mirror		
		531	ray diagram for a converging lens		
		532	the image formed by a lens		
5.1.12.D.3					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.1.12.D.3	5.1 Science Practices	13	measuring time	1	using and understanding photogates
	D. Participate Productively in Science	14	time scales in physics	11	using a velocity sensor and data collection system
	Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.	27	practice measuring with a metric ruler	13	using a velocity sensor and data collection system
		67	measuring weight vs. measuring mass	15	using photogates
		116	how spring scales work vs. truck scales	21	use an electronic scale
		222	theromometer scales	51	use a spring scale
		301	using a multimeter to measure current	54	use a spring scale
		303	using a multimeter to measure resistance	58	use a spring scale
				61	using a timer and photogates
				63	using a timer and photogates
				74	use a temperature sensor and data collecton system
				93	use a multimeter
				95	use a multimeter to measure current
				96	use a multimeter to measure resistance of a pot
				97	use a multimeter to measure voltage drop
				100	use a multimeter to measure voltage
				101	use a multimeter to measure current
				110	use a multimeter to measure voltage
				125	use a multimeter to measure voltage
				125	use a timer and photogate to measure speed of rotor
				138	use a timer and photogate to measure the period of a pendulum
				152	use a spring scale

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.2.12.A.1	5.2 Physical Science	245	atomic structure models	77	identify atomic number
	A. Properties of Matter	245	development of atom models	77	atomic structure
	Use atomic models to predict the behaviors of atoms in interactions.	252	the Bohr model and electron shells	80	model how atoms exchange energy
		253	quantum model of the atom		
		253	quantum model of the atom		
		341	matter is made of atoms		
5.2.12.A.2	5.2 Physical Science	220	physical differences between phases of matter	71	studying water's phase changes
	A. Properties of Matter	221	phase changes	71	investigate energy and phase changes
	Account for the differences in the physical properties of solids, liquids, and gases.	355	plasma and lightning	72	apply concept of energy and phase changes
				72	arrangement of solid, liquid, gas particles
5.2.12.A.3	5.2 Physical Science			78	using the periodic table
	A. Properties of Matter				
	Predict the placement of unknown elements on the Periodic Table based on their physical and chemical properties.				
5.2.12.A.4	5.2 Physical Science	247	weak force explained	77	investigate isotopes
	A. Properties of Matter	249	radioactive decay	78	find mass number of specific isotope
	Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.	249	isotopes explained	82	investigate concepts of radioactivity
		259	radioactive materials	83	radioactivity and the environment
				83	investigate concept of half-life
5.2.12.C.1					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.2.12.C.1	5.2 Physical Science	219	kinetic theory and temperature	69	compare and contrast heat and temperature
	C. Forms of Energy	221	heat energy and molecular motion	72	investigating heat of fusion with water
	Use the kinetic molecular theory to describe and explain the properties of solids, liquids, and gases.			73	investigate heat transfer
5.2.12.C.2	5.2 Physical Science	221	heat energy and molecular motion	71	studying water's phase changes
	C. Forms of Energy	221	boiling and melting points	72	apply concept of energy and phase changes
	Account for any trends in the melting points and boiling points of various compounds.				
5.2.12.D.1	5.2 Physical Science	85	calculating potential energy	19	constant height data table
	D. Energy Transfer and Conservation	86	potential to kinetic energy conversions	29	create a height reference scale
	Model the relationship between the height of an object and its potential energy.	88	potential to kinetic energy conversions	64	calculate energy
		114	potential and kinetic energy in a spring		
5.2.12.D.3	5.2 Physical Science	256	nuclear reactions explained	82	investigate concepts of radioactivity
	D. Energy Transfer and Conservation	257	nuclear reactions and energy	83	radioactivity and the environment
	Describe the products and potential applications of fission and fusion reactions.	258	fusion reactions		
		259	fission reactions		
5.2.12.D.4					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.2.12.D.4	5.2 Physical Science	92	momentum and collisions	31	investigate momentum
	D. Energy Transfer and Conservation			31	investigating momentum and the third law
	Measure quantitatively the energy transferred between objects during a collision.				
5.2.12.E.1	5.2 Physical Science	17	speed defined	3	speed defined and calculated
	E. Force and Motion	17	speed of light	4	measure the speed of the car
	Compare the calculated and measured speed, average speed, and acceleration of an object in motion, and account for differences that may exist between calculated and measured values.	18	calculating speed	11	compare and contrast speed and velocity
		18	speed units	14	create and study a velocity vs. time graph
		19	velocity defined	16	collect data to calculate the car's acceleration
		35	acceleration defined	17	create and study a velocity vs. time graph
		37	acceleration and velocity	19	why did the speed change?
		38	position vs. time graphs	26	find the speed of the car
		39	position vs. time graph for accelerating motion	49	find the launch speed of the marble
		40	speed vs. time graph	60	measure speed of car
		41	speed vs. time graph for accelerating motion	61	experiment and find average speed
		43	finding distance from a speed vs. time graph	63	measure speed of car
		64	velocity defined		
		69	terminal speed		
		69	skydiving and terminal speed		
		136	speed vs. velocity		
		143	angular speed		
5.2.12.E.2					

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Standard	Description	Volume 1 Student Text		Volume 2 Investigation Manual	
5.2.12.E.2	5.2 Physical Science	63	calculations pertaining to free fall	23	investigate free fall
	E. Force and Motion	63	effect of gravity on motion	44	investigate projectile motion
	Compare the translational and rotational motions of a thrown object and potential applications of this understanding.	137	projectile explained	49	find the average range of the launched marble
		138	free fall component of a trajectory	49	find the launch speed of the marble
		142	angular speed vs. linear speed		
		169	work and gravity		
		412	gravitational field		
5.2.12.E.3	5.2 Physical Science	55	Newton’s first law	18	investigate Newton's first law of motion
	E. Force and Motion	81	applying third law		
	Create simple models to demonstrate the benefits of seatbelts using Newton's first law of motion.	95	car crash safety		
5.2.12.E.4	5.2 Physical Science	59	Newton’s second law	20	second law of motion
	E. Force and Motion	59	quantitative understanding of second law	21	Newton's second law and the Atwood's machine
	Measure and describe the relationship between the force acting on an object and the resulting acceleration.	60	applying Newton’s second law properly	21	investigate second law of motion
		61	using second law formula	35	using Newton's second law
		436	Newton’s second law and oscillators	37	predict the acceleration of the car on the ramp