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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1HCS1.1.a Nature and Application of Science and Technology	History and Context of Science	Science is an international activity in which significant inventions and innovations have come from around the world…	Investigate various scientific concepts, inventions, and technological innovations that have been developed by different world cultures such as astronomy in Asia, or metallurgy in Africa…	41	Galileo and Newton conducted experiments with balls on ramps	75	the discovery of atom's nucleus
				52	Dr. Harold Edgerton and strobe photography		
				52	Dr. Harold Edgerton and strobe photography		
				78	Newton's laws of motion		
				81	Newton's discovery of the connection between force and mass and acceleration		
				91	biomechanics application		
				92	applications of biomechanics		
				112	impact of technology		
				152	Sir Isaac Newton and law of universal gravitation		
				155	first artificial human-made Earth satellite was Sputnik		
				178	Great Pyramid of Giza and simple machines		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				269	wave motion and equilibrium		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				290	technological breakthrough of sound recording		
				310	past theories of light		
				325	history of printing		
				348	the usefulness of recorded images		
				349	Galileo and telescopes		
				349	the telescope		
				350	Newtonian reflecting telescope		
				361	Young's double-slit experiment		
				368	Einstein's thinking revolutionized physics		
				382	Ben Franklin and current		
				420	Charles-Augustin de Coulomb		
				447	discovering and using magnetism		
				499	development of atomic theory		
				501	search for elements and alchemy		
				561	the Alvin research submarine		
				575	discovery of helium		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				580	Newton and classical physics		
				625	turning lead into gold		
1HCS1.1.b Nature and Application of Science and Technology	History and Context of Science	Science is an international activity in which significant inventions and innovations have come from around the world…	Select a contemporary or technological challenge such as HIV, cancer research, space exploration, or ozone depletion. Explore the dimensions of the issue and the kinds of collaborative efforts that are in place to deal with it …	234	gyroscopes and the space shuttle		
				236	rocket engines		
				259	measuring mass in space		
				392	environmental impact of auto pollution		
				621	human technology contributes to radiation in environment		
				628	nuclear waste		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1HCS1.2.a Nature and Application of Science and Technology	History and Context of Science	Science is divided into many disciplines such as astrophysics, biochemistry, and geophysics. Each discipline is a field of endeavor in itself and requires specialized training…	Investigate the development of new scientific disciplines both historical, such as Lavoisier's work in forming the foundation of modern chemistry, and contemporary such as molecular biology…	41	Galileo and Newton conducted experiments with balls on ramps	75	the discovery of atom's nucleus
				52	Dr. Harold Edgerton and strobe photography		
				78	Newton's laws of motion		
				81	Newton's discovery of the connection between force and mass and acceleration		
				91	biomechanics application		
				92	applications of biomechanics		
				152	Sir Isaac Newton and law of universal gravitation		
				349	Galileo and telescopes		
				350	Newtonian reflecting telescope		
				382	Ben Franklin and current		
				420	Charles-Augustin de Coulomb		
				440	magnetism		
				447	history of magnetism		
				499	development of atomic theory		
				501	ancient Greeks' ideas of elements		
				580	Newton and classical physics		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				614	Marie Curie		
				615	Henri Bequerel and beta rays		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1HCS1.2.b Nature and Application of Science and Technology	History and Context of Science	Science is divided into many disciplines such as astrophysics, biochemistry, and geophysics. Each discipline is a field of endeavor in itself and requires specialized training…	Select a major scientific discovery (e.g., DNA, transistor, x-rays, antibiotics) and discuss the influence of this discovery on the thoughts and work that followed in a variety of scientific disciplines.	13	medical and health professions use physics		
				16	the relation between physics and other fields of science		
				52	Dr. Harold Edgerton and strobe photography		
				52	Dr. Harold Edgerton and strobe photography		
				91	biomechanics application		
				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		
				257	Pierre and Jacques Curie and the piezoelectric effect		
				269	wave motion and equilibrium		
				290	technological breakthrough of sound recording		
				310	past theories of light		
				325	history of printing		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				348	the usefulness of recorded images		
				349	the telescope		
				361	Young's double-slit experiment		
				368	Einstein's thinking revolutionized physics		
				447	discovering and using magnetism		
				449	Earth's magnetism		
				501	search for elements and alchemy		
				561	the Alvin research submarine		
				575	discovery of helium		
				592	connections between biology and chemistry and physics		
				625	turning lead into gold		
				641	research on future of the universe		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1HCS1.3.a Nature and Application of Science and Technology	History and Context of Science	Scientific theories are based on the body of knowledge that exists at any particular time…	Trace the evolution and progression of a theory surrounding an important area of scientific development such as structure of the atom, origin and evolution of the universe, or formation of Earth's geological features …	41	Galileo and Newton conducted experiments with balls on ramps	75	the discovery of atom's nucleus
				78	Newton's laws of motion		
				81	Newton's discovery of the connection between force and mass and acceleration		
				152	Sir Isaac Newton and law of universal gravitation		
				349	Galileo and telescopes		
				350	Newtonian reflecting telescope		
				382	Ben Franklin and current		
				420	Charles-Augustin de Coulomb		
				499	development of atomic theory		
				580	Newton and classical physics		
				614	Marie Curie		
				615	Henri Bequerel and beta rays		
				641	research on future of the universe		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1HCS1.3.b Nature and Application of Science and Technology	History and Context of Science	Scientific theories are based on the body of knowledge that exists at any particular time…	Review selected scientific articles from popular magazines and newspapers such as New York Times, Science Times over an extended period of time. Identify a scientific theory that is currently being modified…				

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.1.a Nature and Application of Science and Technology	Science as Inquiry	The identification and formulation of appropriate questions guide the design and breadth of a scientific investigation.	Formulate scientific investigations from relevant questions and issues. Formulate questions to indicate conceptual insights and a depth of understanding around these questions and issues.	3	inquiry starts with questions	11	formulate a testable hypothesis
				8	formulating a hypothesis	21	plan the experiment
				9	testing ideas against scientific evidence	33	formulate a testable hypothesis
				432	making a simple capacitor	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
						89	what is it that moves in the case of a wave?
						201	determine the equipment you will need
						201	design a procedure to separate a mixture

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.2.a Nature and Application of Science and Technology	Science as Inquiry	Scientific investigations in many cases follow no fixed set of steps. However, there are certain features of a valid scientific investigation that are essential and result in evidence that can be used to construct explanations.	Design and conduct a scientific investigation either as an individual or group activity. The investigation should be sufficiently complex to require the use of various experimental techniques and strategies…	9 432	testing ideas against scientific evidence making a simple capacitor	21 28 67 82 82 85 85 129 201 201 202	conduct the experiment set up the ultimate pulley set up the straight track plan three experiments to determine which variable affects the period of a pendulum design an experiment select appropriate technology to make measurements design and test a way to increase natural frequency choose circuit parts to light a bulb determine the equipment you will need design a procedure to separate a mixture conduct your experiment

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.3.a Nature and Application of Science and Technology	Science as Inquiry	Tools and technologies extend human capabilities to perform investigations in more detail and with greater accuracy and improved precision. Expand the capacity to use a variety of tools and techniques in order to solve a wide range of practical problems.	Following instructions in manuals or taking instructions from an experienced person to learn the proper use of new instruments.	18	measuring distance	1	estimating length
				23	reading a digital timer	4	using a timer
				25	accuracy and precision of measurements	5	using photogates
						6	accuracy and resolution and printing
				25	accuracy and precision of measurements	9	using timer and photogates
				383	using a multimeter to measure voltage	11	using timer and photogates
				385	measuring current with an ammeter or multimeter	14	using a timer and photogates
				387	using a multimeter to measure resistance	17	using a timer and photogates
				504	Celsius and Fahrenheit thermometers	18	use a timer and photogates
				505	how thermometers work	21	conduct the experiment
						21	use a timer and photogates
						23	use a timer and photogates
						26	use a timer and photogates
						28	set up the ultimate pulley
						42	use a timer and photogates
						43	measure and record the distance
						47	use a timer and photogate

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						50	use a timer and photogate
						58	use a timer and photogate
						60	measure input and output forces
						65	use a timer and photogate
						67	measure vertical distance
						67	set up the straight track
						67	use a timer and photogate
						75	use a timer and photogates
						82	measure the length of the string
						82	use a timer and photogate
						85	select appropriate technology to make measurements
						85	design and test a way to increase natural frequency
						87	use photogate and timer to measure the period
						90	use a timer and photogates
						129	choose circuit parts to light a bulb
						131	use a multimeter to measure current

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						132	use a multimeter to measure voltage
						135	use a multimeter to measure current and voltage
						139	use a multimeter
						140	use the multimeter
						163	use a multimeter
						164	use a multimeter to measure voltage
						165	use a multimeter
						166	use a photogate and timer
						169	use a multimeter
						171	use a multimeter
						176	use a thermometer
						178	measure the temperature
						180	measure the temperature
						202	conduct your experiment

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.3.b Nature and Application of Science and Technology	Science as Inquiry	Tools and technologies extend human capabilities to perform investigations in more detail and with greater accuracy and improved precision. Expand the capacity to use a variety of tools and techniques in order to solve a wide range of practical problems.	Using computers to produce tables and graphs and to make spreadsheet calculations.		data tables and graphs can be created on computer or graphing calculator		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.a Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that decide what evidence from an investigation is useful.	2	understanding natural laws	12	was this experiment better or worse than the first?
				3	connecting cause and effect through observation	12	cause and effect relationships
				7	revising explanations through observation	13	is there a trend in measurements?
				8	refining theories based on observations	13	create a graph
				9	connecting cause and effect through analysis	13	compare prediction to measurement
				10	the usefulness of phlogiston theory despite being incorrect	16	create a graph
						16	what do the results tell you?
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	16	describe the graph
						18	are the accelerations different?
				11	Ptolemy model vs. Copernicus model of the solar system	19	does the ball accelerate?
						22	create graphs
				40	making a good model	22	compare calculation with graph estimate
				43	constructing a graph		
				43	graphs are a way of representing data	22	how do you measured positions compare to model?
				44	graphical models	29	does experiment agree with prediction?
				44	checking a graphical model's accuracy	37	make a graph
						38	make a graph
						43	sketch four graphs

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Standard #: Topic Content Standard Performance Standard	student text pg	detail	investigation pg	detail
	44	using a graphical model to make a prediction and checking the model's accuracy	43	what would happen if...?
			43	how does the measurement compare to your prediction?
	45	recognizing patterns and cause and effect relationships	56	create a graph
	45	recognizing patterns using graphs	58	explain why the angular acceleration is different
	54	understanding patterns in relationships between variables	63	as mechanical advantage increases what happens to length of pulled string?
	54	constructing a graph	66	what does the graph tell you?
	55	create a graph from a data table	66	create a graph of speed vs. position
	56	indicate relationships between variables in graphs	76	compare predicted mass to actual mass
			80	explain your observations
	71	parachutes and air resistance	82	make three different graphs
	103	evaluating perpetual motion claims	82	analyze data
			87	sketch a graph
	246	understanding graphs of harmonic motion	87	explain how force applied causes the response
	290	the process of digital sound reproduction	90	what effect does changing the tension have?
	297	frequency spectrum	90	explain why higher tension makes waves move faster
	304	comparison of wave forms from guitar sounds		

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Standard #: Topic Standard	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
			306	explain why hearing can be damaged by loud sounds	92	explain how wind might cause big waves in water
			307	decibel level vs. frequency graph for human hearing	97	did the method give an accurate result?
			411	the waveform of AC electricity	97	reliability of a double-blind test
			427	diagramming electric fields using field lines	109	explain how the colored filters work
			443	diagramming magnetic fields using magnetic field lines	114	are there differences between your prediction and measurement?
			479	current vs.voltage graph for a transistor	132	what conclusions can you draw?
					133	did battery voltage change?
					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

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						204	build models of Na and Cl and use them to explain bonding

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.b Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that use tables, charts, and graphs when making arguments and claims in oral and written presentations.	24	making graphs of experimental results over time	13	create a graph
						15	record data in a table
				42	writing procedures in a lab notebook helps make sure your results are repeatable	16	create a graph
						16	describe the graph
						17	use a data table
				43	constructing a graph	18	record data
				43	constructing a graph	21	record results in table
				44	graphical models	22	create graphs
				54	constructing a graph	27	record position and time data
				55	create a graph from a data table	29	record mass and force
				142	finding x and y components of velocity for model rocket	37	make a graph
						38	make a graph
						43	create four graphs
				290	the process of digital sound reproduction	43	sketch four graphs
						56	create a graph
				411	the waveform of AC electricity	66	record data in table
						66	create a graph of speed vs. position
						70	record data in table
						82	create data table for self-designed experiment
						82	record your data in table
						82	make three different graphs

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						87	sketch a graph
						122	communicate your findings
						122	present your findings
						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
						175	display information you found for your element
						202	keep detailed notes as you work

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.c Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that make and interpret scale drawings.	24 119 499	time scales in physics drawing displacement vector using a scale scale and Brownian motion	28 85 92	interpret setup diagram draw a sketch of your system sketch the wave fronts
1INQ1.4.d Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that form logical arguments about cause and effect relationships in an investigation	2 3 9 45	understanding natural laws connecting cause and effect through observation connecting cause and effect through analysis recognizing patterns and cause and effect relationships	12 90	cause and effect relationships what effect does changing the tension have?

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.e Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that: choose summary statistics to describe group differences, and indicate the spread of the data, as well as the data's central tendency.	412	average voltage and current of AC power	13	is there a trend in measurements?
						25	find the average time
						58	find average of three trials
						63	as mechanical advantage increases what happens to length of pulled string?
						66	what does the graph tell you?
						67	calculate average of three times
						71	calculate average work and power
						82	analyze data
						133	did battery voltage change?

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.f Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that: participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration…	42	writing procedures in a lab notebook helps make sure your results are repeatable	122 122	present your findings communicate your findings
1INQ1.4.g Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that: retrieve pertinent information from reference books, newspapers, magazines, compact discs, and computer data bases.	456 472 499 499	Hans Christian Oersted Dr. D. Bruce Montgomery Albert Einstein Democritus		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.h Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	In an investigation, use various strategies to construct and develop logical explanations that: construct models in order to visualize the relationship of various elements of a product, process, or system.	7	developing models to explain observations	13	create a graph
				11	Ptolemy model vs. Copernicus model of the solar system	13	compare prediction to measurement
				40	making a good model	16	create a graph
				40	creating useful models	16	describe the graph
				43	constructing a graph	22	how do you measured positions compare to model?
				44	graphical models	22	create graphs
				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	uniform acceleration model
				55	create a graph from a data table	22	model for uniform accelerated motion
				60	creating the acceleration formula from experiments	24	create an algebraic model
				66	developing the formulas for a model of motion with constant acceleration	28	solve second law equation for string tension
				101	a model for friction	28	system of Atwood's machine
				102	a model for static friction	29	does experiment agree with prediction?
				202	processes	32	develop a model that predicts acceleration
				204	natural systems and efficiency	37	make a graph
				206	reversible and irreversible processes	38	make a graph
						43	create algebraic model

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Standard #: Topic Content Standard Performance Standard	student text pg	detail	investigation pg	detail
	212	energy flow in systems	43	how does the measurement compare to your prediction?
	214	natural systems work in cycles	43	sketch four graphs
	215	food webs and ecosystems	49	write a formula
	282	write a formula relating velocity of wave to period and wavelength	56	create a graph
	290	the process of digital sound reproduction	66	create a graph of speed vs. position
	297	frequency spectrum	76	compare predicted mass to actual mass
	312	light intensity follows an inverse square law	82	make three different graphs
	330	optics and optical instruments	87	sketch a graph
	411	the waveform of AC electricity	94	give an equation that describes your observations
	449	shifting and reversal of Earth's magnetic poles	114	are there differences between your prediction and measurement?
	492	the binary number system and its use in computers	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

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						189	Bernoulli's equation
1INQ1.4.i Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	Develop the practice of analyzing data, and considering claims by: noticing and criticizing arguments based on the faulty, incomplete, or misleading use of numbers…	25 42 62 188 292 372 576	why accuracy and precision are important controlling variables in experiments acceleration of cars perpetual motion machines sound in space holograms and science fiction special effects ôtransporter beamsö	43 45 202	discuss sources of error discuss sources of errors identify two sources of experimental error

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1INQ1.4.j Nature and Application of Science and Technology	Science as Inquiry	The close examination of evidence is necessary to construct logical scientific explanations and present arguments which defend proposed explanations. Such critical analyses of supporting evidence are not only important to scientific investigations…	Develop the practice of analyzing data, and considering claims by: checking graphs to see that they do not misrepresent results by using inappropriate scales or by failing to specify the axes clearly.	25	why accuracy and precision are important	13	create a graph
				42	controlling variables in experiments	16	create a graph
				43	constructing a graph	16	describe the graph
				44	graphical models	22	create graphs
				54	constructing a graph	37	make a graph
				55	create a graph from a data table	38	make a graph
				290	the process of digital sound reproduction	43	discuss sources of error
				411	the waveform of AC electricity	43	sketch four graphs
						45	discuss sources of errors
						56	create a graph
						66	create a graph of speed vs. position
						82	make three different graphs
						87	sketch a graph
						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

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
						202	identify two sources of experimental error

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1STS1.1.a Nature and Application of Science and Technology	Science, Technology, and Society	The practice of science and technology is not a linear process. In many cases, the desire of scientists to find what is real in nature creates opportunities for technology development.	Investigate a range of modern technological products and systems from the world. Identify those examples in which a scientific advance led to new technological opportunities such as discovery of DNA/biotechnology; splitting of the atom/nuclear energy…	12	engineers design practical devices for solving problems		
				12	all technology is based on fundamental laws of physics		
				31	use of nanotechnology		
				31	use of nanotechnology		
				51	analyzing motion with video and strobe photography		
				72	antilock brakes application		
				72	antilock brakes application		
				112	relationship between science and engineering and technology		
				112	designing a bridge		
				138	use of robots		
				155	geostationary satellites		
				172	bicycle physics application		
				196	hydroelectric power application		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				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		
				369	technological advances have allowed discovery of the expanding universe		
				372	holography application		
				378	importance of electricity		
				392	hybrid gas/electric cars application		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				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		
				516	refrigerator application		
				534	energy-efficient building application		
				534	energy-efficient building application		
				560	deep water submarine Alvin application		
				570	use of radioactive isotopes in medicine		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				585	laser application		
				615	smoke detectors		
				622	x-ray machines		
				623	creation of CAT scans		
				623	CAT scans		
				623	creation of CAT scans		
				631	nuclear power application		
				631	nuclear power application		
				632	nuclear energy		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1STS1.2.a Nature and Application of Science and Technology	Science, Technology, and Society	The social, economic, and political forces of a society have a significant influence on what science and technology programs are pursued, invested in, and used.	Use case studies of actual societal challenges such as sea level change, spread of HIV, and deforestation, and identify and discuss the scientific, technologic, and policy aspects of the various challenges…	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	sources of radiation in the environment		
				621	human technology contributes to radiation in environment		
				628	nuclear waste		
				632	nuclear waste		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
1STS1.2.b Nature and Application of Science and Technology	Science, Technology, and Society	The social, economic, and political forces of a society have a significant influence on what science and technology programs are pursued, invested in, and used.	Investigate how government policy and the circumstances and values of a society determine which science and technology projects are funded and which ones are not, such as Superconducting Supercollider…				
2MS2.1.a Materials and Their Properties	Mixtures and Solutions	Mixtures have variable compositions and are either homogenous or heterogeneous. A homogeneous mixture (solution) has the same properties throughout whereas a heterogeneous mixture consists of two or more phases that differ in properties…	Mixtures have variable compositions and are either homogenous or heterogeneous. A homogeneous mixture (solution) has the same properties throughout whereas a heterogeneous mixture consists of two or more phases that differ in properties…	29 500 501 503 592	describing elements and molecules and mixtures matter is mostly molecules and mixtures elements compounds and elements and mixtures substances and mixtures	175 201	describe one mixture that contains the element separate the mixture and find percent composition

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2MS2.2.a Materials and Their Properties	Mixtures and Solutions	A variety of methods are used to prepare mixtures and to separate mixtures into their component parts. These methods such as blending, grinding, use of surfactants, distillation, floatation, and filtration are used throughout the scientific and industrial	Discuss and demonstrate water purification methods which separate dissolved and suspended materials in water.			175 201	describe one mixture that contains the element separate the mixture and find percent composition
2MS2.3.a Materials and Their Properties	Mixtures and Solutions	The properties of solutions depend upon the concentration, properties, and interactions of the solute and solvents.	Discuss various factors (e.g., type and concentration of solute, type of solvent, and temperature) which affect the rate and extent of solubility and the specific properties of a solution such as acidity, viscosity, B Pt. elevation and F. Pt. depression..	594 594 594 594 600	definition of a solution powders dissolve quickly solubility and temperature water as the universal solvent the pH scale		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2MS2.3.b Materials and Their Properties	Mixtures and Solutions	The properties of solutions depend upon the concentration, properties, and interactions of the solute and solvents.	Identify the effects of human exposure to various materials at low concentrations in air, water, or soil. Report the results using various concentration units and/or data presentations (threshold limits for detecting salt in water, second hand smoke…	570 604 622 623 632	use of radioactive isotopes in medicine balancing chemical equation of acid rain x-ray machines CAT scans nuclear energy		
2MT2.1.a Materials and Their Properties	Material Technology	The properties of materials determine how they are used by society. New material discoveries are being used to improve the quality of life, however, their development often raises social, economic, and environmental issues.	Design an object which requires a variety of materials and defend how the selection depends on the properties and interactions of the chosen materials.	113 534 546	build and test a prototype structure out of toothpicks R-values of common building materials types of solid materials and their properties	83 85 163 191	design and construct a pendulum create a system that oscillates design and test different electric motors build an air-speed tester

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2MT2.1.b Materials and Their Properties	Material Technology	The properties of materials determine how they are used by society. New material discoveries are being used to improve the quality of life, however, their development often raises social, economic, and environmental issues.	Investigate how plastics are tailored to very specific uses and how these uses lead to technological challenges regarding the recycling of plastics. Speculate what determines the price at which a plastic is sold.	546 607	physical properties of plastics impact of combustion reaction of gasoline		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.1.a Materials and Their Properties	Properties and Structure of Matter	All matter is composed of minute particles called atoms. Atoms are electrically neutral and consist of a nucleus of neutrons and positively charged protons surrounded by negatively charged electrons …	Present the various theories and models developed to describe the structure and behavior of the atom. Describe the particles that make up the atom: their size, composition, location, and movement…	420	electric charge is a property of the particles that make up the atom	75	the discovery of atom's nucleus
				420	electric charge is a property of the particles that make up the atom	175	record atomic number
				422	movement of electrons in current	194	basic properties of subatomic particles
				437	draw a model of an atom	194	subatomic particles
				444	magnetism is a property of particles that make up the atom	197	quantum physics
				444	electrons and magnetism	197	quantum theory and electrons
				459	atomic currents	200	explore how a vibrating string has similar properties to a quantum system
				480	electrons in a semiconductor	203	electrons and energy levels
				499	development of atomic theory	203	review subatomic particles
				500	smallest piece of matter is the atom		
				566	three particles make up the atom		
				566	charge and mass of electrons and protons and neutrons		
				567	structure of the atom		
				567	mass and the nucleus		
				569	elements and atoms and atomic number		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				570	chemical properties of isotopes due to atomic structure		
				572	stability of nucleus and balance of protons and neutrons		
				574	Neils Bohr's theory		
				576	Neils Bohr		
				576	quantum states		
				577	energy levels and quantum states		
				577	energy levels explain spectral lines		
				578	quantum state holds one electron		
				579	quantum states are called orbitals in chemistry		
				580	comparing classical and quantum physics		
				581	classical vs. quantum theory of light		
				582	quantum theory		
				582	classical vs. quantum concept of electron		
				583	how the uncertainty principle differs from classical theory		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				583	how the uncertainty principle differs from classical theory		
				583	the uncertainty principle		
				584	quantum theory and probability		
				588	properties of subatomic particles		
				588	quantum states and energy levels		
				589	electrons in classical vs. quantum physics		
				629	conservation of particles in nuclear reactions		
				630	antimatter and neutrinos and other particles		
				646	standard model of particle physics		
				647	matter and antimatter		
				648	standard model of particles		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.2.a Materials and Their Properties	Properties and Structure of Matter	Elements are pure substances that are composed of identical atoms. Chemists and physicists have identified the elements, isolated them from their natural sources, synthesized them from other elements, and determined their properties…	Discuss the features of the periodic table of the elements. Select any element and discuss the utility of the information presented (symbol, atomic number and mass, electron configuration). Locate the various families and groups …	502	how the periodic table is organized	175	record atomic number
				502	the periodic table	175	identify symbol and atomic number and average atomic mass
				569	elements and atoms and atomic number	194	the periodic table
				569	periodic table is arranged by atomic number	194	identify symbol and atomic number and mass number
				570	chemical properties of isotopes due to atomic structure	204	build model of Na and Cl atoms and explain why they bond to form a molecule
				578	periodic table and quantum states		
				596	chemically similar elements and periodic table		
				596	alkali metals		
				598	groups in periodic table related to valence		
				598	arrangement of the periodic table		
				599	alkali metals tend to form ionic bonds		
				612	identifying groups on periodic table		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.3.a Materials and Their Properties	Properties and Structure of Matter	(blank)	Substances are formed by atoms interacting with one another and transferring or sharing electrons. These interactions generally involve the electrons farthest from the nucleus, and result in the formation of chemical bonds	573	chemical reactions	203	how many electrons are in the outermost level?
				593	chemical reactions involve rearrangement of atoms	204	determining oxidation numbers
				595	electrons from chemical bonds	204	what are valence electrons?
				596	valence and chemical bonds	204	modeling a chemical bond
				597	Lewis dot diagrams		
				597	why chemical bonds form		
				598	use of noble gases to prevent chemical bonds in MIG welding		
				599	ionic vs. covalent		
				599	ionic and covalent bonds		
				604	balancing chemical equations in terms of atoms and molecules		
				610	Lewis dot diagrams		
				612	ionic vs. covalent bonds		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.4.a Materials and Their Properties	Properties and Structure of Matter	The properties of compounds depend on the properties and interactions of their molecules. These molecular properties and interactions depend on the kinds of atoms in the molecule, molecular shape and motion, and the electrical forces that exist…	Select a variety of available elements (e.g., iron, magnesium, copper, zinc, carbon, sulfur) and a variety of compounds that contain these elements (e.g., ferric chloride, magnesium sulfate, cupric sulfate, sugar,). Describe the physical nature …	503 592 595	difference between elements and compounds elements and compounds properties of substances are properties of molecules not elements		
2PSM2.4.b Materials and Their Properties	Properties and Structure of Matter	The properties of compounds depend on the properties and interactions of their molecules. These molecular properties and interactions depend on the kinds of atoms in the molecule, molecular shape and motion, and the electrical forces that exist…	Describe water according to its physical properties (e.g., clarity, odor, density, freezing point, boiling point, surface tension). Develop a molecular model of water that can be used to support this description. Discuss the characteristics of oxygen…	594	water as the universal solvent		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.5.a Materials and Their Properties	Properties and Structure of Matter	Elements and compounds exist as solids, liquids, and gases. In solids, the atomic and molecular structure are orderly and nearly rigid and the vibration of atoms and molecules is constrained to a fixed site…	Develop models that describe the structure and behavior of solids, liquids, and gases at the atomic and molecular level. Use these models to discuss the processes of diffusion, boiling, melting, freezing, evaporation, and condensation,…	29	all matter is made of atoms	174	matter is composed of atoms
				30	physical differences between solids and liquids and gases	177	observe a common phase change
				30	relationship between states of matter and arrangement and motion of atoms and molecules		
				33	describe movement of atoms in solids and gases		
				499	idea that matter is made of atoms proved through Brownian motion		
				501	atoms and elements		
				508	characteristics of matter related to its phase		
				508	phases of matter and arrangement of molecules		
				509	melting		
				510	boiling		
				511	evaporation and condensation		
				519	phases of matter		
				595	chemical bonds determine properties of materials		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.6.a Materials and Their Properties	Properties and Structure of Matter	Isotopes of a given element differ in the number of neutrons in the nucleus, although their chemical properties remain essentially the same. Radioactive isotopes spontaneously decay, releasing energy, and/or emitting particles …	Construct a table that organizes critical information (symbol, name, atomic number, number of neutrons, mass number, number of electrons) for a series of elements and their isotopes (carbon, hydrogen, fluorine, lead).	502	the periodic table	175	identify symbol and atomic number and average atomic mass
				570	isotopes explained	194	identify symbol and atomic number and mass number
				571	atomic mass	194	isotopes
				571	atomic mass of stable isotopes	213	explore radioactive isotopes
				572	chart of stable isotopes		
				588	carbon isotopes		
				589	calculate atomic mass and average atomic mass		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2PSM2.6.b Materials and Their Properties	Properties and Structure of Matter	Isotopes of a given element differ in the number of neutrons in the nucleus, although their chemical properties remain essentially the same. Radioactive isotopes spontaneously decay, releasing energy, and/or emitting particles …	Participate in an activity that models and demonstrates the exponential decay curve of radioactive samples. A suggested activity can be found in ChemCom, Chemistry in the Community, 2nd Edition, (ACS).	502	elements past #92 are radioactive and decay	209	radioactive decay and half life
				570	radioactive isotopes	210	simulate radioactive decay
				614	three kinds of radioactivity	211	types of radiation
				614	radioactive decay		
				615	alpha and beta and gamma radiation		
				616	energy and radioactivity		
				617	half-life		
				618	half-life calculation		
				618	carbon dating		
				620	danger of gamma rays and alpha particles		
				634	three kinds of radioactive decay		
				636	half-life of nitrogen-13		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2TCM2.1.a Materials and Their Properties	Transformation and Conservation of Matter	Chemical reactions which take place between the atoms and molecules of elements and compounds occur all around us, for example, combustion, rusting of iron, growing of plants, and cooking of foods. Complex chemical reactions take place constantly…	Identify examples of chemical reactions that take place around us (e.g., cooking, greening of grass, air pollution, combustion of fuel, rusting of metal). Discuss the conditions which must be met in order for these reactions to take place…	579 593 602 607	structure of water molecule chemical change example of burning formation of rust is a chemical reaction reactions of burning gasoline		
2TCM2.2.a Materials and Their Properties	Transformation and Conservation of Matter	Virtually all chemical reactions release or absorb energy. During chemical reactions, energy in the form of heat, light, or electricity is absorbed in the breaking of bonds or released when new bonds are formed…	Investigate how the rate of a chemical reaction such as hydrogen peroxide decomposition or fermentation of sugar can be changed by altering such conditions as temperature and pressure, the concentration of reactants, or addition of a catalyst…				

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2TCM2.2.b Materials and Their Properties	Transformation and Conservation of Matter	Virtually all chemical reactions release or absorb energy. During chemical reactions, energy in the form of heat, light, or electricity is absorbed in the breaking of bonds or released when new bonds are formed…	Prepare reaction pathway diagrams which illustrate the energy relationship of reactants and products and the energy barrier which must be overcome in order for reaction to proceed. Use these diagrams or a set of parameters to balance equations …	596	noble gases and alkali metals	206	is this reaction endothermic or exothermic?
				597	the energy of chemical bonds is described		
				603	endothermic vs. exothermic reactions		
				603	chemical reactions and energy		
				610	energy in reaction of dynamite		
				625	energy changes in nuclear reactions		
				626	source of energy in nuclear reactions		
				627	energy of fusion reactions		
				628	energy of fission reactions		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2TCM2.3.a Materials and Their Properties	Transformation and Conservation of Matter	A large number of reactions, usually in solution, that are important in non-living and living systems, involve the transfer of either electrons (oxidation/reduction) or hydrogen ions (acid/base reactions).	Explore and report on the use of electron transfer and acid base reactions in some common natural or industrial processes such as photosynthesis, manufacture of NH_4NO_3 fertilizer, and manufacture of TiO_2 pigment.	595	electrons from chemical bonds	203	how many electrons are in the outermost level?
				596	valence and chemical bonds	204	determining oxidation numbers
				597	why chemical bonds form	204	what are valence electrons?
				598	use of noble gases to prevent chemical bonds in MIG welding	204	modeling a chemical bond
				599	ionic vs. covalent		
				599	ionic and covalent bonds		
				602	chemical reaction of making water		
				612	ionic vs. covalent bonds		
2TCM2.4.a Materials and Their Properties	Transformation and Conservation of Matter	Regardless of how atoms and molecules in a closed system interact with one another, or how they combine or break apart, the total weight of the system remains the same. (Benchmark for Scientific Literacy, 1993.)	Regardless of how atoms and molecules in a closed system interact with one another, or how they combine or break apart, the total weight of the system remains the same. (Benchmark for Scientific Literacy, 1993.)	605	calculating mass of products and reactions		
				605	mass conservation in chemical reactions		
				612	law of mass conservation		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
2TCM2.5.a Materials and Their Properties	Transformation and Conservation of Matter	Certain small molecules (monomers) react with one another in repetitive fashion (polymerization) to form long chain macromolecules (polymers). The properties of the macromolecules depend on the properties of the molecules used in their formation…	Collect various plastic containers designed to package or hold materials used in daily activities (e.g., soft drinks, milk, cooking oil, sandwiches, yogurt, hot drinks, catsup). Demonstrate the feasibility of a recycle process that would separate …				

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.1.a Energy and Its Effects	Force and Motion	A force acting on an object and moving it though a distance does work on that object and changes it's kinetic energy (energy of motion), potential energy (energy of position), or both. The ratio of output work to input energy is the efficiency…	Analyze and describe qualitatively the changes in potential and kinetic energy of a person participating in an individual sport (e.g., ski-jumping, diving, hitting a ball, and racing).	190	conversions of energy	66	law of conservation of energy
				191	the formula for potential energy	68	calculate potential and kinetic energy
				191	calculate the potential energy of a cart	68	find the total energy at each position
				192	calculating kinetic energy depends on speed and mass	72	potential to kinetic energy conversion in a pendulum
				192	the formula for kinetic energy	72	draw an energy flow diagram
				193	deriving the formula for kinetic energy	74	investigating collisions and conservation of energy
				193	calculate the kinetic energy of a moving car	88	potential to kinetic energy conversions of a pendulum
				194	energy transformations		
				194	energy transformations		
				195	applying conservation of energy for a marble rolling on a hilly track		
				196	energy transformation hydroelectric plant		
				196	energy transformation hydroelectric plant		
				197	conservation of energy for Hoover Dam		
				197	calculating energy supplied by Hoover Dam		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				199	kinetic and potential energy conversions while bouncing in a trampoline		
				202	efficiency and energy conversions		
				205	efficiency in biological systems		
				207	power is the rate of doing work or using energy		
				208	units of power		
				209	calculating power for common devices		
				211	estimate average input power of a person		
				212	energy flow in a pendulum		
				212	energy conversion		
				213	the conversion process of energy flow		
				216	estimating the energy in tides		
				219	energy flow of a model solar car		
				220	calculate energy and power for humans		
				245	kinetic to potential energy changes in motion of an oscillator		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				253	harmonic motion involves both potential and kinetic energy		
				253	oscillators exchange energy back and forth between potential and kinetic		
				256	resonant systems accumulate energy		
				277	waves propagate by exchanging energy between two forms		
				320	photosynthesis converts light energy to chemical energy		
				324	light from chemical reactions		
				356	electromagnetic waves exchange energy between electricity and magnetic parts		
				393	conversion of energy in regenerative braking		
				400	energy conversions in a series circuit		
				451	MRI--energy exchange by a nucleus in a magnetic field		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy		
				467	electric generators transform mechanical energy into electric energy		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.1.b Energy and Its Effects	Force and Motion	A force acting on an object and moving it though a distance does work on that object and changes it's kinetic energy (energy of motion), potential energy (energy of position), or both. The ratio of output work to input energy is the efficiency…	Use a simple machine such as a 10 speed bicycle to investigate the relationship among work, power, and efficiency. Calculate the mechanical advantage and discuss its importance in the use of the machine.	105	friction is the force that keeps nails and screws in place	59	investigate block and tackle machine
				134	forces on an inclined plane	60	operate and study a block and tackle machine
				173	changing gears in a bicycle	61	find the mechanical advantage
				178	input and output for simple machines	62	investigate block and tackle machine
				178	how simple machines manipulate forces	69	calculate efficiency for each ball
				179	types of simple machines	70	calculate work
				179	how to calculate mechanical advantage	70	calculate person's power
				180	the mechanical advantage of a lever	71	calculate work done
				181	how a lever works	71	calculate power output for each climber
				181	how a lever works		
				182	mechanical advantage of ropes and pulleys		
				183	how wheels and gears work		
				184	ramps and screws		
				185	how to calculate work		
				187	calculating work done against gravity		
				191	calculate the potential energy of a cart		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				192	calculating kinetic energy depends on speed and mass		
				193	calculate the kinetic energy of a moving car		
				197	calculating energy supplied by Hoover Dam		
				200	calculate fulcrum point of a lever		
				202	definition of efficiency		
				203	efficiency explained		
				207	power is the rate of doing work or using energy		
				207	calculate power in climbing stairs		
				208	units of power		
				208	power formulas		
				209	calculating power for common devices		
				210	estimating the power in wind		
				211	power in biological systems		
				211	estimate average input power of a person		
				213	efficiency of an energy flow process		
				216	estimating the energy in tides		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				219	ideal vs. real machine		
				220	calculate energy and power for humans		
				220	calculate power rating		
				220	calculate efficiency of model solar car		
				236	fuel efficiency of turbofan engines		
				311	efficiency of electric vs. fluorescent light bulbs		
				393	efficiency of hybrid cars		
				409	power and efficiency of electric cars		
				440	the difference between magnetic poles and electric charge		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.2.a Energy and Its Effects	Force and Motion	Displacement, velocity, acceleration, and time are used to describe the motion or changes in the motion of an object.	Use available data to display graphically the effect of weight, speed, and driver response time on the stopping distance of cars and trucks. Discuss the importance of each variable in determining the overall stopping distance…	13	physics and bicycles	13	graph speed versus position
				48	graphs showing changes in speed	17	find the acceleration
				50	graphs for motion of increasing speed and decreasing speed	25	derive acceleration equation
				61	constant speed and constant acceleration	27	were any forces acting on the ball?
				63	calculating acceleration from a speed vs. time graph	29	calculate the acceleration
				64	calculate speed in accelerated motion	73	calculating momentum
				67	calculate time and distance from acceleration	75	investigate collisions and conservation of momentum
				74	sketching speed vs. time graphs for different changes of motion	77	the momentum form of Newton's second law
				76	analyzing graph for changes in motion		
				78	force is an action that can change motion		
				80	Newton's laws and cup holders		
				81	force is related to acceleration		
				100	friction is a force that resists motion		
				148	centripetal force causes circular motion		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				155	satellite motion application		
				172	force and torque transformations in bicycles		
				173	force and torque transformations in bicycles		
				223	momentum formula and calculating momentum		
				226	solving elastic and inelastic collision problems		
				228	car crash safety		
				229	force on a rocket from change in momentum		
				230	calculate change in momentum for elastic vs. inelastic collisions		
				236	momentum conservation of turbofan engine		
				238	momentum in billiards		
				239	calculate momentum		
				240	forces in a car stopping		
				254	definition of periodic force		
				276	natural frequency and harmonics		

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Foundations of Physics

Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.3.a Energy and Its Effects	Force and Motion	Objects can have linear motion, rotational motion, or both. Newton's Laws can be used to predict changes in linear motion and/or rotational motion. Momentum allows objects to remain in motion after the applied force is removed…	Use Newton's Laws of Motion to investigate the effect of force on velocity, acceleration, and equilibrium of an object. Describe the relationship between the kinetic and potential energy of the object using narrative and/or quantitative descriptions.	13	physics applies to the internal working of the body	17	find the acceleration
				13	biomechanics	25	derive acceleration equation
				13	physics and bicycles	26	study Newton's first law
				61	any acceleration must come from a force	27	explain how Newton's first law applies
				64	calculate speed in accelerated motion	27	were any forces acting on the ball?
				67	calculate time and distance from acceleration	27	collect data on Newton's first law
				78	changes in motion only occur through force	28	investigate Newton's second law
				78	force is an action that can change motion	29	calculate the acceleration
				79	what systems in a car overcome the law of inertia	30	Newton's third law and free body diagrams
				79	all objects tend to resist changes in motion	30	investigate Newton's third law
				80	seat belts and air bags and Newton's first law	31	draw free body diagrams and identify action-reaction pairs
				80	Newton's laws and cup holders	45	balancing a specified force
				81	force is related to acceleration	49	consider forces acting on the ball
				81	Newton's second law of motion	60	operate and study a block and tackle machine
						72	potential to kinetic energy conversion in a pendulum

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				83	calculation using Newton's second law	77	relationship between force and motion and the second law
				83	finding the net force	88	potential to kinetic energy conversions of a pendulum
				84	calculating net force		
				84	Newton's second law and dynamics problems		
				85	if there is acceleration there must be force		
				85	finding force from acceleration		
				85	force problems		
				86	zero acceleration means net zero force		
				87	explaining Newton's third law in terms of an astronaut moving through space		
				87	forces always occur in action-reaction pairs		
				88	Newton's third law operates on pairs of objects		
				88	explaining Newton's third law in terms of moving a skateboard		
				89	solving problems with action-reaction forces		
				89	identifying which force is acting on which object		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				90	the natural jet engine in a squid		
				90	examples of Newton's third law		
				91	force platform used to analyze forces from running and walking		
				92	force from a vertical jump		
				93	problems using Newton's first law and second law		
				94	seat belt problem		
				98	effects of g forces and zero gravity on the human body		
				99	balanced force problems		
				100	friction is a force that resists motion		
				102	the normal force as the reaction in an action-reaction pair		
				103	net force includes the force of friction		
				106	net force must be zero in equilibrium		
				106	Newton's second law and net force		
				107	net force of zero and free-body diagram		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				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		
				116	calculate the acceleration of a toy		
				133	balancing forces in two dimensions		
				135	normal force of an inclined plane		
				136	calculating acceleration on a ramp		
				137	the vector form of Newton's second law		
				137	predicting motion in three dimensions and controlling force and acceleration in space missions		
				137	calculating acceleration from 3-D forces		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				139	determining position by triangulation and inertial navigation		
				141	calculate the net force		
				148	direction of force determines linear or rotational motion		
				148	centripetal force causes circular motion		
				149	calculating centripetal force		
				150	formula for centripetal acceleration		
				150	using centripetal acceleration to create the feeling of gravity by rotating the space station		
				151	banked turns		
				155	satellite motion application		
				156	satellites in orbit		
				168	Newton's first law and rotational inertia		
				169	Newton's second law applies to rotational motion		
				171	Newton's second law for rotational motion variables		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				172	force and torque transformations in bicycles		
				173	force and torque transformations in bicycles		
				178	how simple machines manipulate forces		
				179	how to calculate mechanical advantage		
				180	the mechanical advantage of a lever		
				180	mechanical advantage of human arm		
				181	how a lever works		
				182	mechanical advantage of ropes and pulleys		
				183	how wheels and gears work		
				184	ramps and screws		
				194	energy transformations		
				196	energy transformation hydroelectric plant		
				199	kinetic and potential energy conversions while bouncing in a trampoline		
				212	energy flow in a pendulum		
				222	Newton's first law and momentum		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				224	momentum and Newton's third law		
				228	seat belts and air bags		
				228	Newton's second law relating force and momentum		
				228	car crash safety		
				229	momentum form of Newton's second law		
				234	gyroscopes and the space shuttle		
				238	cars that crumple in a collision		
				240	forces in a car stopping		
				245	kinetic to potential energy changes in motion of an oscillator		
				252	Newton's second law and natural frequency		
				253	oscillators exchange energy back and forth between potential and kinetic		
				254	definition of periodic force		
				425	electric forces always occur in pairs according to Newton's third law		
				440	the difference between magnetic poles and electric charge		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				448	biological compasses of animals		
				548	Newton's third law and pressure in a fluid		
				550	pressure and the third law		
				557	pressure of gases		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.3.b Energy and Its Effects	Force and Motion	Objects can have linear motion, rotational motion, or both. Newton's Laws can be used to predict changes in linear motion and/or rotational motion. Momentum allows objects to remain in motion after the applied force is removed…	Describe different ways in which the effects of twisting forces (torque) are used in everyday situations (e.g., tightening a bolt, using a screwdriver, or opening a combination lock). Demonstrate how the magnitudes of these torques can be altered.	160	center of rotation	53	relationship between force and torque
				160	how torque and force differ	53	calculating torque
				161	line of action and the torque created by a force	54	explore rotational equilibrium and net torque
				161	calculating torque using torque equation	80	torque changes the direction of angular momentum vector
				162	combining torques to find the net torque		
				162	calculating torque		
				163	solve a rotational equilibrium problem		
				163	in rotational equilibrium the net torque is zero		
				164	calculate a torque from an angled force		
				164	when force and lever arm are not perpendicular		
				174	calculating torque		
				174	compare force and torque		
				181	torque and mechanical advantage of a lever		
				183	mechanical advantage of gears		
				234	torque resists change in angular momentum		
				442	torque between two magnets		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FM3.3.c Energy and Its Effects	Force and Motion	Objects can have linear motion, rotational motion, or both. Newton's Laws can be used to predict changes in linear motion and/or rotational motion. Momentum allows objects to remain in motion after the applied force is removed…	Use the law of Conservation of Momentum to describe and discuss the results of a collision between two or more objects (e.g., players in various sports, moving vehicles).	222	comparison of kinetic energy and momentum	73	momentum is a vector
				223	momentum is a vector	73	calculating momentum
				223	momentum formula and calculating momentum	75	investigate collisions and conservation of momentum
				224	law of conservation of momentum	77	the momentum form of Newton's second law
				225	conservation of momentum in collisions	78	which ball had a greater change in momentum?
				226	solving elastic and inelastic collision problems	79	investigate angular momentum
				226	applying conservation of momentum	80	explain life application of conservation of momentum
				227	momentum conservation for collisions in two and three dimensions	80	angular momentum behaves like a vector
				229	force on a rocket from change in momentum		
				230	calculate change in momentum for elastic vs. inelastic collisions		
				230	impulse formula		
				231	conservation of angular momentum examples		
				231	what is angular momentum		
				232	angular momentum depends on speed and mass and shape		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				232	conservation of angular momentum		
				233	formula for angular momentum		
				235	jet engines work because of conservation of momentum		
				236	momentum conservation of turbofan engine		
				237	why is momentum a vector		
				238	momentum in billiards		
				238	difference between impact and impulse		
				239	calculate momentum		
				276	natural frequency and harmonics		
				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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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.1.a Energy and Its Effects	Forms/Sources of Energy	Electromagnetic radiation is a form of energy which can exhibit both wave and particle characteristics and does not require a material medium for its transmission. The energy of the radiation depends on both the intensity (brightness) and frequency.	Conduct experiments to demonstrate wave characteristics such as propagation, frequency, wavelength, amplitude, and interference for both mechanical and electromagnetic waves. Discuss how these characteristics are used in modern devices (e.g.sonar, radar).	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	making wave pulses on a string
				249	analyze the motion of the cycle of a pendulum	89	study characteristics of a wave pulse on a string
				251	systems tends to have a preferred frequency	89	study wave pulses on elastic cord
				258	identify period and frequency and cycle and amplitude	90	study the speed of the wave pulse
				260	calculate speed of an oscillator	90	measure speed of a wave pulse
				262	waves are all around us	91	make different types of waves in a ripple tank
				264	frequency and amplitude and wavelength in waves	91	making circular waves in a ripple tank
				264	basic properties of frequency and wavelength and amplitude	91	is your water wave transverse or longitudinal?
				265	wave pulse	91	making plane waves in a ripple tank
				265	concept of speed of a wave	93	investigate frequency and wavelength
				266	formula for speed of a wave	94	investigate harmonic wave patterns
				266	speed of a wave is the speed at which a cycle moves	94	investigate the wavelength of standing waves

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				267	transverse and longitudinal waves	94	investigate the frequency of standing waves
				267	water waves are transverse and Slinky is longitudinal	96	investigate human perception of sound
				268	creating plane waves and circular waves	101	investigate interference with sound waves
				268	one- and two- and three-dimensional waves	125	study the polarization of a transverse spring wave
				273	constructive and destructive interference		
				273	sound and light waves and interference		
				275	standing waves on a string		
				276	concept of harmonics		
				277	standing waves are used to store energy		
				277	energy of a wave is proportional to frequency and amplitude		
				277	standing waves on a string		
				278	nodes and antinodes		
				278	modes of a wave		
				278	wavelength of a standing wave		
				279	vibration of a drum		
				279	modes of vibration		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				281	microwaves		
				281	use of microwaves in microwave ovens		
				282	describe relationship between wave characteristics		
				283	type of wave represented by a spring		
				286	properties of sound waves		
				286	sound waves require matter to traverse		
				289	acoustics		
				292	sound is a longitudinal wave		
				292	importance of wavelength of sound waves		
				295	designing a musical instrument		
				295	standing wave patterns of sound		
				296	design of a good concert hall		
				296	interference of sound waves		
				298	sonograms		
				301	echolocation and beats		
				301	consonance and dissonance and beats		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				302	harmonics and frequency and the color of sound		
				302	musical instruments		
				303	design of a guitar		
				303	sound from a guitar		
				306	beats in a musical sound		
				308	wave amplitude and harmonics of tuning fork and musical instrument		
				359	descriptions of radio waves and microwaves and infrared rays		
				359	waves of the electromagnetic spectrum		
				360	x-rays and gamma rays		
				452	MRI uses radio waves		
				452	MRI--each nucleus is a resonant oscillator		
				530	electromagnetic radiation		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.2.a Energy and Its Effects	Forms/Sources of Energy	Electricity results from the movement of electric charges through a complete circuit under the influence of an applied voltage. The electric current flowing in any circuit or part of a circuit depends on the voltage and resistance and can be calculated …	Construct parallel and series circuits and apply Ohm's law when evaluating the circuits.	386	relationship between current and resistance	134	Ohm’s law
				388	Ohm's law	135	derive Ohm’s law from experiment
				396	calculation of voltage from resistance and current	136	use Ohm’s law to calculate the resistance
				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
				399	calculating current in a series circuit using Ohm's law	138	apply Ohm’s law to series circuits
				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	171	use Ohm’s law to calculate the resistance of the transistor
				403	using Ohm's law in parallel circuits		
				403	resistance in parallel circuits		
				404	using Ohm's law for circuit analysis		
				405	voltage dividers		
				406	comparing series and parallel circuits		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				407	solving network circuits		
				407	solving network circuits		
				407	calculate currents and voltages in a network circuit		
				414	why series circuits are not used in homes and buildings		
				414	why parallel circuits are used in homes and buildings		
				415	compare current in a series and parallel circuit		
				416	using Ohm's law to calculate current		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.2.b Energy and Its Effects	Forms/Sources of Energy	Electricity results from the movement of electric charges through a complete circuit under the influence of an applied voltage. The electric current flowing in any circuit or part of a circuit depends on the voltage and resistance and can be calculated …	Outline the differences between AC and DC current, and discuss the reasons for their use in specific applications.	411	definition of AC current		
				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		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.3.a Energy and Its Effects	Forms/Sources of Energy	Electric forces between charged objects are attractive or repulsive. The electric forces between electrons and protons are attractive, determine the structure of atoms, and are involved in all chemical reactions …	Discuss the role that attractive electric forces between electrons and protons have in determining the structure of the atom.	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	electric charge is a property of the particles that make up the atom	149	investigate charged balloons
				420	explanation of coulomb	194	basic properties of subatomic particles
				421	current is the flow of charge		
				422	negative charge of electrons and current flow		
				422	movement of electrons in current		
				423	static electricity and charge polarization and induction		
				424	relationship of electric force and charge		
				425	the force between charges		
				426	charge creates an electric field		
				428	source charges and test charges		
				430	a capacitor stores charge		
				433	ability of a capacitor to store charge is capacitance		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				444	magnetism is a property of particles that make up the atom		
				459	atomic currents		
				480	electrons in a semiconductor		
				500	smallest piece of matter is the atom		
				566	charge and mass of electrons and protons and neutrons		
				567	mass and the nucleus		
				568	forces in the atom		
				588	properties of subatomic particles		
				626	strong force and electromagnetic force in the nucleus		
				649	four forces in nature		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.4.a Energy and Its Effects	Forms/Sources of Energy	Magnetic forces and electric forces are thought of as different aspects of a single electromagnetic force. Moving electric charges produce magnetic fields which exert magnetic force on other objects and produce electric forces…	Construct an electromagnet and demonstrate how it can be used. Investigate the relationship between the magnetic force and the electric current. Discuss the advantages and disadvantages of permanent magnets vs. electromagnets.	435	steering the electron beam on television screen	159	build an electromagnet
				456	magnetic field of a wire	160	study the right-hand rule
				457	right-hand rule	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?
				458	coils and solenoids	165	investigate electromagnetic induction
				459	the magnetic field of coils and permanent magnets		
				461	calculate magnetic field at the center of a coil		
				462	coils used in electromagnets		
				462	finding the poles of an electromagnet using right-hand rule		
				462	electromagnets		
				463	adding turns increases an electromagnet's strength		
				463	building an electromagnet		
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy		
				465	how electromagnets are used in electric motors		
				467	concept of electromagnetic induction		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				471	transformers operate on electromagnetic induction		
				472	electromagnet-based maglev		
				475	using right-hand rule		
				475	diagram of electromagnet		
3FSE3.4.b Energy and Its Effects	Forms/Sources of Energy	Magnetic forces and electric forces are thought of as different aspects of a single electromagnetic force. Moving electric charges produce magnetic fields which exert magnetic force on other objects and produce electric forces…	Devise an experiment to generate an electric current using a wire and a magnet. Measure the magnetic field resulting from the flow of the current.	458	coils and solenoids	165	investigate electromagnetic induction
				459	the magnetic field of coils and permanent magnets	165	investigate Faraday's law of induction
				461	calculate magnetic field at the center of a coil		
				462	coils used in electromagnets		
				463	adding turns increases an electromagnet's strength		
				467	concept of electromagnetic induction		
				468	magnetic flux		
				469	Faraday's law of induction		
				471	transformers operate on electromagnetic induction		
				473	Eddy currents		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.5.a Energy and Its Effects	Forms/Sources of Energy	Chemical energy is derived from the gain or loss of electrons between atoms during the making and breaking of chemical bonds. The energy released or absorbed in a chemical reaction can be predicted and measured…	Measure heat evolved or absorbed in a chemical reaction. Discuss how energy and matter are conserved in the reaction.	194	the law of conservation of energy	206	is this reaction endothermic or exothermic?
				194	conservation of energy explained		
				195	conservation of energy in a closed system		
				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		
				553	energy conservation and Bernoulli's equation		
				596	noble gases and alkali metals		
				597	the energy of chemical bonds is described		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				603	chemical reactions and energy		
				603	endothermic vs. exothermic reactions		
				610	energy in reaction of dynamite		
				625	energy changes in nuclear reactions		
				626	source of energy in nuclear reactions		
				627	energy of fusion reactions		
				628	energy of fission reactions		
				629	conservation of energy in nuclear reactions		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3FSE3.6.a Energy and Its Effects	Forms/Sources of Energy	Nuclear energy is related as heat, light, or radiation when a portion of the mass of the nucleus is converted to energy. The nuclear forces which hold the nucleus of an atom together are much stronger that the repulsive electric forces between protons…	Compare the matter and energy relationships in nuclear fission, and nuclear transmutations with those in fossil fuels. Discuss the advantages and disadvantages of each for power generation.	196	environmental impacts of hydroelectric power	143	the cost of using electrical appliances
				196	hydroelectric power system		
				197	efficiency of the Hoover Dam		
				217	extracting tidal power		
				217	advantages of tidal energy		
				470	energy for generators		
				570	use of radioactive isotopes in medicine		
				597	the energy of chemical bonds is described		
				602	hydrogen as a fuel		
				608	alternate fuels to gasoline		
				618	power released by radioactive decay		
				621	sources of radiation in the environment		
				622	x-ray machines		
				623	CAT scans		
				625	energy changes in nuclear reactions		
				626	source of energy in nuclear reactions		
				627	energy of fusion reactions		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				628	energy of fission reactions		
				631	nuclear power application		
				631	nuclear power application		
				632	nuclear energy		
				632	nuclear waste		
				632	nuclear energy		
				634	comparison of fission and fusion		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3IEM3.1.a Energy and Its Effects	Interactions of Energy and Materials	Energy waves may interact with materials leading to the formation of heat or other forms of energy. These interactions, which depend upon the nature of the wavelength of the radiation, can be used to create practical devices such as electric heaters,…	Investigate the reflection, refraction, transmission, or absorption of light waves by various materials.	310	how we see	106	study refraction in a prism
				315	light bends as it moves into a material	106	use a mirror to study how light behaves
				315	mirrors	106	study reflection in a prism
				315	light rays bounce off a surface	113	study how refraction works
				317	how the human eye sees color	114	study the critical angle of refraction in a prism
				318	how we perceive color	114	study index of refraction
				319	we see mostly reflected light	123	study light interference
				324	the process of how light is reflected	123	study light diffraction patterns
				324	the process of how light is reflected		
				331	lenses bend light		
				331	mirrors reflect light		
				332	specular and diffuse reflection		
				332	the image in a mirror		
				333	finding the normal line for reflection		
				334	the index of refraction		
				334	refraction is the bending of light rays		
				335	refraction depends on index of refraction in both materials		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				336	total internal reflection and the critical angle		
				336	how fiber optics work		
				338	how the human eye sees images		
				339	the image formed in a mirror		
				340	design of a lens		
				345	diffraction spot size image defect		
				353	explain fiber optic cables		
				353	explain index of refraction		
				358	index of refraction is ratio of speed of light in material to speed of light in vacuum		
				361	interference of light waves and Young's double-slit experiment		
				362	diffraction grating		
				364	transmission of light through two polarizers		
				372	three-dimensional images and the human eye		
				373	holograms and the interference of light		
				376	fiber optic cable calculation		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				530	absorption of thermal radiation		
				531	blackbody and perfect absorption of light		
				574	absorption of light		
				586	emission and absorption of photons in laser light		
3IEM3.1.b Energy and Its Effects	Interactions of Energy and Materials	Energy waves may interact with materials leading to the formation of heat or other forms of energy. These interactions, which depend upon the nature of the wavelength of the radiation, can be used to create practical devices such as electric heaters,…	Identify the different ways in which electrical conductors, insulators, and semiconductors respond to an electric potential. Discuss the differences in terms of the particulate model of matter.	390	classifying materials as conductor or insulator or semiconductor		
				395	classify conductivity of materials		
				421	negative charges move in a conductor		
				422	atomic structures of conductors and insulators and semiconductors		
				429	using a conductor as shielding from electric fields		
				480	conductivity and semiconductors		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3IEM3.2.a Energy and Its Effects	Interactions of Energy and Materials	When radiation energy is absorbed or emitted by individual atoms or molecules, the changes in energy involve the jump of an electron from one distinct energy level to another, These energy changes, which are characteristic of the atom or molecule,…	Use flame tests to identify the various elements in a mixture. Discuss how scientists use this technique to analyze unknown materials or celestial bodies.	575	spectral analysis of the sun		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3IEM3.2.b Energy and Its Effects	Interactions of Energy and Materials	When radiation energy is absorbed or emitted by individual atoms or molecules, the changes in energy involve the jump of an electron from one distinct energy level to another, These energy changes, which are characteristic of the atom or molecule,…	Describe things which are luminous such as fireflies, marine organisms, and the Sun vs. things which are illuminated such as the Moon, street signs, or bike reflectors.	310 317 318 319 324 357 362 375 574 575 575 638	how we see how the human eye sees color how we perceive color we see mostly reflected light the process of how light is reflected relationship between frequency and energy and color of light diffraction patterns and the spectrometer relate color to frequency for visible light emission/absorption spectrum spectrum of hydrogen spectral analysis of the sun spectral-line patterns and red shift	110 124 197	all light is produced by atoms use a spectrometer to measure wavelength of different colors of light absorption and emission of light by atomic electrons

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3PCAE3.1.a Energy and Its Effects	Production /Consumption/ Application of Energy	Demand for energy by society leads to continuous exploration in order to expand supplies of fossil fuels (e.g., drilling deeper oil and gas wells, drilling offshore). In addition, technology has been developed to create alternate energy sources…	Compare the advantages and disadvantage (including cost) of different finite and renewable energy sources and identify their applications.	196	environmental impacts of hydroelectric power	143	the cost of using electrical appliances
				196	hydroelectric power system		
				217	advantages of tidal energy		
				217	extracting tidal power		
				470	energy for generators		
				602	hydrogen as a fuel		
				608	alternate fuels to gasoline		
				618	power released by radioactive decay		
				631	nuclear power application		
				632	nuclear energy		
				632	nuclear energy		
				634	comparison of fission and fusion		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3PCAE3.1.b Energy and Its Effects	Production /Consumption/ Application of Energy	Demand for energy by society leads to continuous exploration in order to expand supplies of fossil fuels (e.g., drilling deeper oil and gas wells, drilling offshore). In addition, technology has been developed to create alternate energy sources…	Investigate the extent to which energy efficiency programs involving a major societal use of energy (e.g., transportation, farming, manufacturing, producing electricity) lead to reduction in the amount of a natural resource consumed.	197 219 392 534 631	efficiency of the Hoover Dam using energy efficient products hybrid cars combine advantages of gasoline fuel and electric power energy-efficient building application nuclear power application		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3PCAE3.2.a Energy and Its Effects	Production /Consumption/ Application of Energy	Advances in the scientific understanding of synthetic materials have provided new devices (e.g., transistors, light emitting diodes, optical switches, superconducting ceramics) used in electronic equipment. This has revolutionized many aspects of life…	Analyze the function of a modern electronic device (e.g., remote control unit, CD player) and compare its use with the device which was previously used for the same function. Describe the advantages offered by the replacement …	470	generating electricity by induction	166	build a generator
				471	transformers	168	explore the properties of diodes
				478	diodes and the bias voltage	170	understand the uses of transistors in circuits
				479	transistors	170	measure voltage and current characteristics of a transistor
				483	p-n junction is a diode		
				484	half-wave rectifier is a single diode AC-DC converter		
				485	transistors act as electronic switches		
				486	a transistor amplifier		
				487	electronic logic and transistor circuits		
				495	knowing a diode's bias voltage		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3PCAE3.3.a Energy and Its Effects	Production /Consumption/ Application of Energy	The increase in energy demand has environmental consequences, and societal expectations for a sustainable environment will require new, cleaner technologies for the production of energy.	Working in groups, explore examples of the environmental impact of energy sources used extensively in the past such as peat, wood, or water and the societal and technological changes which altered their use. Using this as background, propose approaches …	12	engineers design practical devices for solving problems	143	the cost of using electrical appliances
				31	use of nanotechnology		
				72	antilock brakes application		
				112	designing a bridge		
				138	use of robots		
				155	geostationary satellites		
				196	environmental impacts of hydroelectric power		
				196	hydroelectric power application		
				209	range of power for common devices		
				216	energy from ocean tides		
				217	advantages of tidal energy		
				217	research into tidal power		
				219	using energy efficient products		
				228	seat belts and air bags		
				235	jet engines application		
				257	quartz crystals application		
				280	microwave ovens application		
				293	uses of Doppler radar		
				311	invention of electric light		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				325	the printing press		
				349	the telescope		
				378	importance of electricity		
				392	hybrid cars combine advantages of gasoline fuel and electric power		
				392	hybrid gas/electric cars application		
				413	wiring application		
				434	how television works application		
				451	MRI application		
				490	why computers are useful		
				534	energy-efficient building application		
				534	energy-efficient building application		
				602	hydrogen as a fuel		
				608	alternate fuels to gasoline		
				618	power released by radioactive decay		
				623	creation of CAT scans		
				631	nuclear power application		
				632	nuclear energy		
				634	comparison of fission and fusion		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3TCE3.1.a Energy and Its Effects	Transformation and Conservation of Energy	Energy can be transformed from one form into another, but the total energy is constant in a closed system. The amount of energy involved in any process, and the rate at which it is generated or consumed can be discussed qualitatively and measured…	Measure the heat released when the energy stored in fuels (or foods) is released upon combustion. Discuss and account for the energy balance in the process.	190	conversions of energy	72	draw an energy flow diagram
				194	the law of conservation of energy		
				194	conservation of energy explained		
				194	energy transformations		
				195	conservation of energy in a closed system		
				196	energy transformation hydroelectric plant		
				202	efficiency and energy conversions		
				203	efficiency and conservation of energy		
				205	efficiency in biological systems		
				206	connection between efficiency and time		
				212	energy conversion		
				213	the conversion process of energy flow		
				215	energy flows in biological systems		
				219	energy flow of a model solar car		
				227	kinetic energy conservation for elastic collisions		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				256	resonant systems accumulate energy		
				277	waves propagate by exchanging energy between two forms		
				320	photosynthesis converts light energy to chemical energy		
				324	light from chemical reactions		
				356	electromagnetic waves exchange energy between electricity and magnetic parts		
				370	relationship and conservation of mass and energy		
				393	conversion of energy in regenerative braking		
				400	energy conversions in a series circuit		
				451	MRI--energy exchange by a nucleus in a magnetic field		
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy		
				467	electric generators transform mechanical energy into electric energy		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				469	energy conservation and Faraday's law		
				509	temperature change and thermal energy		
				513	definition of calorie		
				513	transfer of thermal energy		
				514	the heat equation		
				515	thermodynamics and conservation of energy		
				516	refrigerator application		
				517	air conditioners		
				535	sources of heat transfer in buildings		
				552	conservation of energy in fluids		
				553	energy conservation and Bernoulli's equation		
				597	the energy of chemical bonds is described		
				603	chemical reactions and energy		
				610	energy in reaction of dynamite		
				625	energy changes in nuclear reactions		
				626	source of energy in nuclear reactions		
				627	energy of fusion reactions		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
				628	energy of fission reactions		
				629	conservation of energy in nuclear reactions		
3TCE3.1.b Energy and Its Effects	Transformation and Conservation of Energy	Energy can be transformed from one form into another, but the total energy is constant in a closed system. The amount of energy involved in any process, and the rate at which it is generated or consumed can be discussed qualitatively and measured…	Determine the amount of heat required to change the temperature or phase of a material (e.g., the latent heat of a phase change for various materials).	509	heat of fusion		
				509	changing from solid to liquid		
				509	temp vs. time graph for phase change of ice to water		
				509	temp vs. time graph for phase change of ice to water		
				509	heat of fusion		
				510	heat of vaporization		
				510	changing from liquid to gas		
				510	heat of vaporization		
				511	evaporation and condensation		
				519	temp vs. time graphs for various materials		
				520	temp vs. time curve question		
				606	energy from sunlight stored through photosynthesis		

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Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3TCE3.2.a Energy and Its Effects	Transformation and Conservation of Energy	Energy can be transferred from one place to another by gross movement of material (e.g. wind, waterfalls, thrown ball), by mechanical waves moving through a material medium (e.g., sounds, earthquakes, tidal waves), or by electromagnetic waves…	Discuss in terms of the properties of waves, the apparent change in a train whistle as the train passes. Research and discuss the application of these properties in the measurement of distance and relative movement(e.g.of stars, of local weather systems).	293 294 307 638 639	definition of the Doppler effect Doppler effect and supersonic and subsonic motion understanding of Doppler effect Doppler effect and red shift the big bang		

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Student Text and Investigation Manual

Standard #: Standard	Topic	Content Standard	Performance Standard	student text pg	detail	investigation pg	detail
3TCE3.3.a Energy and Its Effects	Transformation and Conservation of Energy	Mass is converted to large quantities of energy in the processes of nuclear fission and fusion. The energy released can be calculated using the equation E=mc2. The total of energy and mass is constant in these processes.	Compare the energy release from a material (e.g., 1gm. of hydrocarbon) burned as a chemical fuel to the energy available if the same mass were converted through nuclear decay (E=mc2).	370	Einstein's mass-energy formula	128	the equivalence of mass and energy
				597	the energy of chemical bonds is described		
				616	energy and radioactivity		
				625	energy changes in nuclear reactions		
				625	nuclear reactions can convert mass into energy		
				626	source of energy in nuclear reactions		
				627	energy of fusion reactions		
				628	energy of fission reactions		
				629	energy is stored as mass in nuclear reactions		
				647	energy released in reactions between matter and antimatter		