

**Correlation to Pennsylvania Academic Standards for Science: Physics, Chemistry,
and Inquiry by the end of grade 10**

***Foundations of Physical Science* Student Text and Investigation Manual**

Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.2.10.A1 Grade 10	Inquiry and Design	Apply knowledge and understanding about the nature of scientific and technological knowledge.	Compare and contrast scientific theories and beliefs.	60 review theories based on observations 60 historical context and perspective of discoveries 61 review scientific hypothesis based on comparison with evidence 62 evaluate how research shapes scientific knowledge 63 critique based on evidence 475 Benjamin Franklin	97 review your hypothesis

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1		Volume 2		
Grade level				Student Text page		Investigation Manual page		
3.2.10.A2	Inquiry and Design	Apply knowledge and understanding about the nature of scientific and technological knowledge.	Know that science uses both direct and indirect observation means to study the world and the universe.	21	significant differences	10	how do results compare	
Grade 10				42	interpretation of patterns from graphs and tables	17	observing	
				47	interpretation of patterns in data	19	interpreting observations	
				59	construct explanations supported by direct and indirect evidence	23	explain any differences you see	
				88	interpretations of patterns in data	24	test your prediction	
				136	35	interpret observations	36	construct algebraic model from data
					36	construct reasonable explanations back by scientific evidence	36	construct reasonable explanations back by scientific evidence
					45	collect force data	64	collect observational data
					64	collect observational data	87	build models of Na and Cl and use them to explain bonding
					87	build models of Na and Cl and use them to explain bonding	96	interpret observations
96	interpret observations	97	perform the experiment you designed					
97	perform the experiment you designed	125	constructing explanations					
125	constructing explanations	129	investigate variables that affect the period of a pendulum					
129	investigate variables that affect the period of a pendulum	168	interpret observations					
168	interpret observations	247	observations					
247	observations							

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.2.10.A3 Grade 10	Inquiry and Design	Apply knowledge and understanding about the nature of scientific and technological knowledge.	Integrate new information into existing theories and explain implied results.	59 64	10 how do results compare 19 analyze scientific hypothesis based on scientific evidence 23 explain any differences you see 32 analyze hypothesis based on comparison with evidence 36 analyze hypothesis based on data 36 construct reasonable explanations back by scientific evidence 97 do the data support the hypothesis 125 constructing explanations

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.2.10.B1	Inquiry and Design	Apply process knowledge and organize scientific and technological phenomena in varied ways.	Describe materials using precise quantitative and qualitative skills based on observations.	4	measurement and units	1	selecting tools of measurement
Grade 10				5	English vs SI	1	volume measurement
				5	measuring with SI units	3	how close were predictions
				6	understanding units for length and mass	3	precision and accuracy
				10	understand length measurements in metric units	9	precision
				10	understand length measurement	11	volume measurements
				10	measurement	27	compare prediction to graph
				11	length measurement	28	understand the sensitivity of a measuring tool
				18	significant digits	36	construct algebraic model from data
				20	accuracy and precision and resolution	45	collect force data
				33	measure volume of regular and irregular objects using several methods	45	measure and record the force
				60	understand sensitivity of measuring tools	47	measure height difference
				79	length units	59	compare prediction to results
						64	collect observational data
			66	find the volume			
			129	collect mass and amplitude data			
			129	make precise length measurements			

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
					233 understanding length measurements
					233 measuring
					234 measuring
					235 length measurements
					235 measuring
					236 measuring
					239 measurements
					239 measure volume of regular objects
					240 measurements
					240 volume of regular objects
					241 measure volume of regular objects
					241 measurements
					242 measure volume of regular objects
					243 measure volume of irregular objects

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page	
3.2.10.B2 Grade 10	Inquiry and Design	Apply process knowledge and organize scientific and technological phenomena in varied ways.	Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions.	46 62 63 64 65 78 88 297 469 469	identifying cause and effect relationships describe steps of the scientific method formulate a testable hypothesis recognizing and controlling variables in observations and experiments writing lab procedures variables identify cause and effect relationships why is Earth's atmosphere different from other planets scientific method design experiment—including choosing equipment	17 18 19 19 19 21 24 25 31 35 35 46 50 50 69 87 96
					identify cause and effect relationships formulate a testable hypothesis recognizing controlling variables interpreting observations cause and effect relationships make a hypothesis test your prediction selecting ramp and photogates formulate a testable hypothesis interpret observations recognizing and controlling variables rigging block and tackle controlling variables controlling variables conduct scientific inquiry build models of Na and Cl and use them to explain bonding interpret observations	

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
					97 perform the experiment you designed
					97 select materials from list
					97 plan procedures and select materials
					97 design experiment to find out if mass is conserved
					129 design pendulum experiment
					129 plan three experiments to determine which variable affects the period of a pendulum
					129 perform self-designed experiment
					129 investigate variables that affect the period of a pendulum
					168 interpret observations
					176 rigging block and tackle
					230 design experiment that someone else can follow

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.2.10.B3 Grade 10	Inquiry and Design	Apply process knowledge and organize scientific and technological phenomena in varied ways.	Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.	43 making graphical model from data 44 creating graphical model from data 46 constructing graph from data 46 make predictions 47 constructing a graph 87 graphs 88 making and evaluating graphs 114 using algebraic formulas 128 using algebraic model 145 using algebraic models 170 kinetic energy formula 192 kinetic energy formula 197 the power equation 256 the heat equation 271 density formula 304 pressure and temperature relationship 488 equation for Ohm's law 559 harmonic motion graphs 564 calculating wave speeds	3 how close were predictions 7 unit canceling 11 graph mass vs. volume 12 use graph to predict mass of six objects 14 make predictions based on observations 18 make predictions 23 create a graph 23 use graph to make prediction 25 predict what graph will look like 25 predict what graph will look like 27 compare prediction to graph 29 make graph from data 35 graphical models 42 create a graph 42 derive a formula 45 create a mathematical model 51 find math rule for lever equilibrium

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
					53 make predictions based on data
					59 compare prediction to results
					69 make predictions on observed data
					71 derive Boyles law
					71 graph pressure vs volume
					71 predict the pressure
					73 graph pressure vs temperature
					99 study the graph
					104 create a solubility curve
					130 use data to predict best string length for a pendulum clock
					133 give an equation that describes your observations
					193 make predictions based on inferences from data
					248 lab notebook
					249 making graphs

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.2.10.C1 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Generate questions about objects, organisms and/or events that can be answered through scientific investigations.	297 why is Earth's atmosphere different from other planets	69 conduct scientific inquiry 97 design experiment to find out if mass is conserved 129 perform self-designed experiment 129 design pendulum experiment
3.2.10.C2 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Evaluate the appropriateness of questions.	297 why is Earth's atmosphere different from other planets	69 conduct scientific inquiry 97 design experiment to find out if mass is conserved 129 perform self-designed experiment 129 design pendulum experiment

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3.2.10.C3 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Design an investigation with adequate control and limited variables to investigate a question.	46 identifying cause and effect relationships 64 recognizing and controlling variables in observations and experiments 78 variables 88 identify cause and effect relationships	17 identify cause and effect relationships 19 interpreting observations 19 cause and effect relationships 19 recognizing controlling variables 35 interpret observations 35 recognizing and controlling variables 50 controlling variables 50 controlling variables 71 does the graph support hypothesis 87 build models of Na and Cl and use them to explain bonding 96 interpret observations 129 evaluate statistical significance 168 interpret observations

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.2.10.C4 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Conduct a multiple step experiment.	65 writing lab procedures 469 design experiment—including choosing equipment	25 selecting ramp and photogates 46 rigging block and tackle 69 conduct scientific inquiry 97 plan procedures and select materials 97 design experiment to find out if mass is conserved 97 select materials from list 129 design pendulum experiment 129 perform self-designed experiment 176 rigging block and tackle 230 design experiment that someone else can follow

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1		Volume 2	
Grade level				Student Text page		Investigation Manual page	
3.2.10.C5	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Organize experimental information using a variety of analytic methods.	43	using data tables	2	data table
Grade 10				43	making graphical model from data	7	unit canceling
				44	creating graphical model from data	11	graph mass vs. volume
				46	constructing graph from data	12	data table
				47	constructing a graph	13	data table
				87	graphs	13	data tables
				88	making and evaluating graphs	17	data tables
				114	using algebraic formulas	17	data tables
				128	using algebraic model	19	data tables
				145	using algebraic models	23	create a graph
				170	kinetic energy formula	23	data table
				192	kinetic energy formula	25	predict what graph will look like
				197	the power equation	26	data tables
				256	the heat equation	29	make graph from data
				271	density formula	29	analyze trends from data
				304	pressure and temperature relationship	29	data tables
				488	equation for Ohm's law	31	data tables
559	harmonic motion graphs	35	data tables				
564	calculating wave speeds	35	graphical models				
				42	derive a formula		
				42	create a graph		

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
					45 create a mathematical model
					51 find math rule for lever equilibrium
					57 sketch the shape of the graph
					69 data tables
					71 derive Boyles law
					71 graph pressure vs volume
					73 graph pressure vs temperature
					95 data tables
					96 data tables
					97 design a data table
					99 study the graph
					104 create a solubility curve
					133 give an equation that describes your observations
					232 data tables
					236 data tables
					248 data tables
					248 lab notebook
					249 making graphs

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.2.10.C6 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Judge the significance of experimental information in answering the question.	21	finding estimated error	3	how close were predictions
				59	construct explanations supported by direct and indirect evidence	10	how do results compare
				64	analyze hypothesis based on data	15	find average time
						19	analysis of errors
						19	analyze scientific hypothesis based on scientific evidence
						23	explain any differences you see
						24	calculate percent error
						27	compare prediction to graph
						32	analyze hypothesis based on comparison with evidence
						36	analyze hypothesis based on data
						36	construct reasonable explanations back by scientific evidence
						59	compare prediction to results
						71	does the graph support hypothesis
						97	do the data support the hypothesis
						125	constructing explanations

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
					129 evaluate statistical significance
3.2.10.C7 Grade 10	Inquiry and Design	Apply the elements of scientific inquiry to solve problems.	Suggest additional steps that might be done experimentally.	21 finding estimated error 46 make predictions 65 writing lab procedures	12 use graph to predict mass of six objects 14 make predictions based on observations 18 make predictions 19 analysis of errors 23 use graph to make prediction 24 calculate percent error 25 predict what graph will look like 53 make predictions based on data 69 make predictions on observed data 71 predict the pressure 130 use data to predict best string length for a pendulum clock 193 make predictions based on inferences from data 230 design experiment that someone else can follow

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.2.10.D1 Grade 10	Inquiry and Design	Identify and apply the technological design process to solve problems.	Examine the problem, rank all necessary information and all questions that must be answered.	50	solving design problems	97	plan procedures and select materials
				50	steps of design cycle		
				70	sample engineering problem		
				315	design and test model		
				469	design experiment—including choosing equipment		

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3.2.10.D2 Grade 10	Inquiry and Design	Identify and apply the technological design process to solve problems.	Propose and analyze a solution	21	finding estimated error	10	how do results compare
				50	solving design problems	19	analysis of errors
				59	construct explanations supported by direct and indirect evidence	19	analyze scientific hypothesis based on scientific evidence
				64	analyze hypothesis based on data	23	explain any differences you see
						24	calculate percent error
						24	test your prediction
						32	analyze hypothesis based on comparison with evidence
						36	construct reasonable explanations back by scientific evidence
						36	analyze hypothesis based on data
						97	do the data support the hypothesis
						97	perform the experiment you designed
						125	constructing explanations
						129	investigate variables that affect the period of a pendulum

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3.2.10.D3 Grade 10	Inquiry and Design	Identify and apply the technological design process to solve problems.	Implement the solution.	315	design and test model	24	test your prediction
						25	selecting ramp and photogates
						46	rigging block and tackle
						97	select materials from list
						97	perform the experiment you designed
						129	investigate variables that affect the period of a pendulum
						176	rigging block and tackle
3.2.10.D4 Grade 10	Inquiry and Design	Identify and apply the technological design process to solve problems.	Evaluate the solution, test, redesign and improve as necessary.	50	solving design problems	71	does the graph support hypothesis
				315	design and test model	129	evaluate statistical significance
3.2.10.D5 Grade 10	Inquiry and Design	Identify and apply the technological design process to solve problems.	Communicate the process and evaluate and present the impacts of the solution.	65	write up results	231	communicating results is essential to science
				68	scientific journals	231	writing up results
				381	communicating—graphica lly	232	writing up results
						249	making graphs

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.4.10.A1 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable.	228 matter is composed of atoms 229 definition of atom 314 atoms are made up of protons and neutrons and electrons 315 protons neutrons and electrons 316 basic properties of an atom and the three subatomic particles 318 understand how atomic structure determines the identity of elements—atomic number 319 structure of an atom and three smaller particles 320 explain what isotopes are 321 explain what isotopes are 321 three subatomic particles and their charge 326 electron shells 335 idea of atomic mass 337 explain what isotopes are 337 atomic number on the periodic table 472 atoms are the source of electric charge	75 what isotopes are 75 atomic symbol and atomic number and mass number 75 Bohr model 75 understand the structure of an atom based on protons and neutrons and electrons 78 understand the structure of an atom based on protons and neutrons and electrons 78 structure of an atom 79 what isotopes are 79 identify symbols and atomic number and mass number 82 identify symbol and atomic number and mass number of elements 85 review subatomic particles 201 build atomic models

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Grade level					
				473 matter is made of atoms	

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.4.10.A2 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.	335 describe periodic table 335 recognizing groups or families on the periodic table 335 common chemical properties in relation to the periodic table 336 identify metals and nonmetals on the periodic table 338 describing periodic table 338 recognizing groups and families of periodic table 338 common chemical properties of elements based on relation to periodic table 338 recognizing metals and nonmetals and metalloids 339 explain common chemical properties in relation to placement on periodic table 340 describe periodic table 340 recognizing groups and families and periodic table 342 properties in relation to periodic table	77 periodic table 80 build and describe periodic table 83 identify metals and nonmetals and metalloids 83 recognizing groups or families 83 periodic table 84 periodic table 86 build model of Na and Cl atoms and explain why they bond to form a molecule

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
				342 describe periodic table	
				343 chemical properties in relation to periodic table	
				343 groups on periodic table	
				347 describe characteristics based on place in periodic table	
				356 properties of elements in relation to the periodic table	
				357 explain the chemical properties of elements in relation to periodic table	
				358 explain chemical properties based on location in periodic table	
				362 periodic table and oxidation numbers	
3.4.10.A3 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations.	302 Boyle's law and the behavior of gases 305 importance of Charles' law	70 Boyles law 72 investigate pressure and temperature of a gas

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3.4.10.A4 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Describe phases of matter according to the Kinetic Molecular Theory.	38 physical differences between states of matter 240 physical differences between phases of matter 240 phases of matter 242 phase changes 277 explain matter states based on arrangement of atoms	28 forces as ability to change motion 64 colloidal suspension 64 compare solids and liquids

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3.4.10.A5 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).	342 354 354 355 355 355 356 357 358 359 361 362 363	how electron interactions create bonds difference between covalent and ionic bonds how electrons are involved in bonds how electrons are involved in bonds difference between ionic and covalent bonds how ions are formed how electron interactions help create chemical bonds how electrons are involved in bonds how electrons are involved in bonding how electrons are involved in bonding electron transfer and oxidation number chemical bonding and the periodic table distinguish between ionic compounds and covalent molecules	89 90	predict chemical formulas name chemical compounds

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
				363 explain why ions are formed	
				364 apply rules for writing formulas of simple chemical compounds	
				368 qualitative understanding of how electron interactions create bonds	
				369 rules for writing formulas	
				440 compare covalent and ionic bonds	
				456 how ions are formed	
3.4.10.A6 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Recognize formulas for simple inorganic compounds.	364 apply rules for writing formulas of simple chemical compounds	89 predict chemical formulas
				369 rules for writing formulas	90 name chemical compounds

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3.4.10.A7 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Describe various types of chemical reactions by applying the laws of conservation of mass and energy.	356 energy changes that accompany chemical reactions	92 chemical equations
				388 history of law of conservation of mass	93 practice balancing equations
				391 balanced chemical equations	95 investigate law of conservation of mass
				391 chemical equations	96 investigate and recognize that the chemical reactions can be represented as systems with reactants and products
				392 balancing chemical equations	
				394 chemical reactions in living systems	96 law of conservation of mass
				398 synthesis or addition reactions	98 exothermic and endothermic reactions
				399 decomposition reactions	99 exothermic and endothermic reactions
				400 double displacement reactions	
				400 single displacement reactions	
				410 explain how energy is manifested in chemical reactions—exothermic and endothermic	
				411 analyze energy changes that accompany chemical reactions	
				411 how energy is manifested in chemical reactions	

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				413 endothermic reactions 419 reaction rate	
3.4.10.A8 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Apply knowledge of mixtures to appropriate separation techniques.	230 understanding mixtures 360 mixtures can be separated by physical means	177 freezing point of a stable mixture
3.4.10.A9 Grade 10	Physical Science, Chemistry and Physics	Explain concepts about the structure and properties of matter.	Understand that carbon can form several types of compounds.	375 how special properties of carbon make the great variety of biomolecules 380 understand that carbon and hydrogen and nitrogen combine to form biomolecules	192 explain how special bonding properties of carbon make possible the great variety and complexity of biomolecules 192 carbon and hydrogen and nitrogen and oxygen combine to form biomolecules 193 understand that carbon and hydrogen and nitrogen and oxygen combine to form biomolecules

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3.4.10.B1 Grade 10	Physical Science, Chemistry and Physics	Analyze energy sources and transfers of heat.	Determine the efficiency of chemical systems by applying mathematical formulas.	356 energy changes that accompany chemical reactions 410 explain how energy is manifested in chemical reactions—exothermic and endothermic 411 analyze energy changes that accompany chemical reactions 411 how energy is manifested in chemical reactions 413 endothermic reactions 417 percent yield 419 reaction rate 444 factors such as particle size that influence rate of dissolving	95 investigate law of conservation of mass 96 law of conservation of mass 98 exothermic and endothermic reactions 99 exothermic and endothermic reactions

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3.4.10.B2 Grade 10	Physical Science, Chemistry and Physics	Analyze energy sources and transfers of heat.	Use knowledge of chemical reactions to generate an electrical current.	410 explain how energy is manifested in chemical reactions—exothermic and endothermic 411 how energy is manifested in chemical reactions 457 determine pH ranges of solutions 460 pH range 461 pH ranges 463 pH ranges 483 how batteries work	105 create a pH scale
3.4.10.B3 Grade 10	Physical Science, Chemistry and Physics	Analyze energy sources and transfers of heat.	Evaluate energy changes in chemical reactions.	356 energy changes that accompany chemical reactions 411 analyze energy changes that accompany chemical reactions 413 endothermic reactions	98 exothermic and endothermic reactions 99 exothermic and endothermic reactions

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3.4.10.B4 Grade 10	Physical Science, Chemistry and Physics	Analyze energy sources and transfers of heat.	Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion).	149 150 152 152 152 153 154 155 169 170 174 177 178 181	Newton's third law—action and reaction Newton's third law—qualitative calculating momentum momentum defined law of conservation of momentum understanding the law of conservation of momentum solving momentum problems Newton's third law potential energy explained kinetic energy explained energy transformations and conservation law of conservation of energy using energy conservation to solve problems conservation of energy in a broader context	34 38 38 40 41 42 63 168	qualitative understanding of $F = ma$ investigate momentum and the 3rd law of motion Newton's third law—action and reaction energy in a system potential and kinetic energy conservation of energy conservation of energy Newton's third law—action and reaction

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3.4.10.B5 Grade 10	Physical Science, Chemistry and Physics	Analyze energy sources and transfers of heat.	Explain resistance, current and electro-motive force (Ohm's Law).	476 electric current 478 resistors 481 current in simple circuits 482 understanding voltage 484 measuring current with a multimeter 486 understanding electrical resistance 487 measuring resistance 488 Ohm's law 490 resistance of common objects 492 resistors 500 series circuits 501 resistance in a series circuit 501 current in a series circuit 503 voltage in a series circuit 504 Ohm's law and voltage drops 507 parallel circuits 507 current in a parallel circuit 508 voltage in a parallel circuit 511 parallel circuits in homes	109 series circuit 110 explore the concept of voltage 112 apply the concept of electrical resistance 118 build a parallel circuit

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page		
3.4.10.C1 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Identify the relationship of electricity and magnetism as two aspects of a single electromagnetic force.	472 473 473 528 529 530 535 537 537 541 542 543	understanding electric charge charged objects and static electricity what causes shocks what is a magnet using magnetic forces concept of magnetic field what is an electromagnet? increased current vs. strength of magnetic field building an electromagnet how an electric motor works dissecting an electric motor electromagnetic induction explained	108 108 124	concept of electric current concept of electrical charge investigate relationship between magnetism and electricity using electromagnets

**Correlation to Pennsylvania Academic Standards for Science: Physics, Chemistry,
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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.4.10.C2 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Identify elements of simple machines in compound machines.	206	simple machines	45	discover mechanical advantage of ropes and pulleys
				207	simple machines and forces	49	investigate how simple machines work
				213	how a rope and pulley system works	51	investigate simple machines—input and output force
				216	how simple machines manipulate forces	52	demonstrate how simple machines work
				217	pliers as an example of a lever	52	analyze result of changing force of distance in a lever as demonstrated by arm
						52	investigate how simple machines work
						53	demonstrate how simple machines work—mechanical advantage
3.4.10.C3 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Explain fluid power systems through the design and construction of appropriate models.	33	investigate density of fluid	14	investigating density
				276	density of fluids	68	apparent density
				285	investigate buoyancy		
				286	investigate properties—including buoyancy		
				289	investigate buoyancy		

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.4.10.C4 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Describe sound effects (e.g., Doppler effect, amplitude, frequency, reflection, refraction, absorption, sonar, seismic).	560 resonance explained 568 refracted waves 568 reflected waves 569 transverse waves 569 longitudinal waves 570 destructive interference 579 acoustics 580 speed of sound 581 sound as a wave 582 how sound is recorded 584 sound as a wave 587 standing waves and resonance 588 acoustics of concert halls 593 pitch and the musical scale 594 frequency of sound and beats 620 absorption 620 wave interactions like reflection 620 refraction	131 investigate frequency and wavelength 132 investigating resonance 133 natural frequency and resonance of standing waves on a string 136 investigate interference with sound waves 137 investigating sound resonance 213 demonstrate waves using slinky 214 reflection 214 demonstrate waves using slinky 215 wave characteristics through water 215 categorize waves by how they move 215 making circular waves in a ripple tank

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.4.10.C5 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Describe light effects (e.g., Doppler effect, dispersion, absorption, emission spectra, polarization, interference).	322 explain how we see color in terms of reflected or emitted light 450 factors that affect solubility 581 electromagnetic waves in common technology (i.e. radar) 604 seeing and reflected light 605 light is produced by atoms 606 white light is a mixture of colors 607 speed of light 608 wavelength and frequency of visible light 608 energy and color of light 609 what makes light 609 nature of light in terms of waves and energy info flow 610 uses of electromagnetic waves 610 electromagnetic spectrum 610 properties of electromagnetic waves with different wavelengths 612 how the human eye sees light	144 investigate RGB and CMYK models of color 145 investigate colors of light 147 investigate law of reflectior 149 study refraction in a prism 149 study reflection in a prism

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
				613	
					how the human eye sees color
				614	
					the RGB color process
				615	
					subtractive color process
				615	
					how light helps us see
				615	
					color as reflected light
				616	
					the CMYK color process
				617	
					color seen as reflected light
				617	
					explain how colors of light relate to wavelength
				619	
					mirrors reflect light
				620	
					how light helps us see
				621	
					reflection of light
				621	
					refraction of light
				622	
					reflection explained

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Standard #:	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.4.10.C6	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Describe and measure the motion of sound, light and other objects.	78	concept of speed	20	finding speed
Grade 10				79	calculating speed	22	find speed of car
				81	speed	26	position vs time graph
				81	compare and contrast speed and velocity	27	calculate car's acceleration
				82	compare and contrast speed and velocity	27	speed vs time graph
				87	calculating speed	30	investigate the effects of friction on motion of objects
				87	changes in motion can be represented graphically	31	investigate effects of friction on motion
				89	position vs. time graphs	31	compare speeds of cars
				89	calculating speed	32	investigate rolling and sliding friction
				89	changes in motion can be shown graphically	32	effects of friction
				90	changes in motion can be represented graphically	33	calculate speed of car
				90	speed vs. time graph	33	positive and negative acceleration
				91	compare and contrast speed and velocity	36	calculate acceleration
				91	constant velocity	36	quantitative understanding of force as a rate of change of velocity
				91	speed vs. time graph		
				91	calculations for speed	36	conceptual idea of acceleration as change in speed
				92	conceptual understanding of acceleration as describing change in speed	39	find speed of car

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page		
				95	speed vs. time graph	133	waves carry energy from one place to another
				96	effect of gravity on motion		
				98	projectile explained	213	wavelength and frequency and speed of waves
				99	quantitative understanding of acceleration as change in speed	214	wavelength and frequency and speed of waves
				113	effect of gravity on objects		
				117	effect of friction on motion		
				118	effects of friction on motion of objects		
				119	effects of friction on motior		
				120	effects of friction on motior		
				121	effects of friction		
				122	effects of friction		
				123	effects of friction on motior		
				124	compare and contrast constant and changing velocity		
				126	effects of gravity		
				129	effect of friction on motion		
				138	compare and contrast constant and changing velocity		
				143	acceleration is a rate of change of speed		

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				143	
				147	
				155	
				190	
				554	
				556	
				556	
				556	
				558	
				562	
				563	
				581	
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				607	
				609	

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
3.4.10.C7 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Know Newton's laws of motion (including inertia, action, and reaction) and gravity and apply them to solve problems related to forces and mass.	93 quantitative understanding of acceleration as a rate of change of velocity 96 effect of gravity on motion 98 projectile explained 99 Newton's second law 108 forces needed to change motion 108 understand force as an action with potential to change motion 113 effect of gravity on objects 117 effect of friction on motion 118 effects of friction on motion of objects 119 effects of friction on motior 119 changes in motion require application of force 120 effects of friction on motior 121 effects of friction 122 effects of friction 123 effects of friction on motior 125 balanced and unbalanced forces	30 investigate the effects of friction on motion of objects 31 investigate effects of friction on motion 32 investigate rolling and sliding friction 32 effects of friction 34 investigate the 2nd law of motion 34 second law of motion 34 qualitative understanding of $F = ma$ 37 qualitative understanding of Newton's third law 38 Newton's third law—action and reaction 38 Newton's second law 168 Newton's third law—action and reaction 168 Newton's second law

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
				126	
				change in motion require force	
				126	
				effects of gravity	
				127	
				use concepts of balanced or unbalanced forces	
				127	
				quantitative understanding of force changing motion	
				129	
				effect of friction on motion	
				129	
				unbalanced forces cause motion	
				138	
				conceptual understanding of a force as the action with the potential to change motion	
				138	
				changes in motion require force	
				139	
				change in motion requires force	
				141	
				force is an action with potential to change motion	
				143	
				Newton's second law	
				144	
				Newton's second law—qualitative	
				144	
				Newton's second law—qualitative	
				144	
				Newton's second law—qualitative	

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page	Volume 2 Investigation Manual page
				148	
				149	
				149	
				150	
				152	
				154	
				155	
				155	
				168	
				190	
				558	

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Standard #: Grade level	Category	Standard Statement	Standard Descriptors	Volume 1 Student Text page		Volume 2 Investigation Manual page	
3.4.10.C8 Grade 10	Physical Science, Chemistry and Physics	Distinguish among the principles of force and motion.	Determine the efficiency of mechanical systems by applying mathematical formulas.	169	potential energy explained	41	potential and kinetic energy
				170	kinetic energy explained	42	conservation of energy
				177	law of conservation of energy	176	work out cannot be more than work in
				178	using energy conservation to solve problems		
				194	efficiency explained		