

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.I.I.01 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.	Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions.	2	understanding natural laws	11	recognizing and controlling variables
				3	connecting cause and effect through observation	12	cause and effect relationships
				3	inquiry starts with questions	28	set up the ultimate pulley
				9	testing ideas against scientific evidence	43	write a procedure
				9	connecting cause and effect through analysis	43	follow the scientific method
				9	connecting cause and effect through analysis	67	set up the straight track
				40	defining variables	79	safety note
				42	writing lab procedures	82	plan three experiments to determine which variable affects the period of a pendulum
				42	control and experimental variables		
				43	dependent and independent variables in graphs	82	dependent and independent variables
				45	recognizing patterns and cause and effect relationships	82	determine which variable has the greatest effect
				54	importance of changing one variable at a time in an experiment	85	design and test a way to increase natural frequency
				251	changing the natural frequency of a stretched rubber band	89	what is it that moves in the case of a wave?
543	safety factors	90	what effect does changing the tension have?				
		129	safety precautions				
		131	safety precautions				
		150	safety note				

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					159 safety note 160 electromagnet safety 166 variables that affect the performance of the generator 176 heat safety 176 safety note 185 safety tip 192 gas pressure safety note 201 determine the equipment you will need 201 develop a procedure 202 conduct your experiment 206 acid safety

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.1.1.02 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.	Design and conduct scientific investigations.	9	testing ideas against scientific evidence	21	conduct the experiment
				242	finding a basic cycle of harmonic motion	21	plan the experiment
				293	demonstrating the Doppler effect	28	set up the ultimate pulley
				432	making a simple capacitor	43	perform experiment
				456	an experiment with a wire and compass	65	investigate motion on a roller coaster
				463	building an electromagnet with wire and a nail	65	studying motion of ball on loop track
				467	experiment demonstrating electromagnetic induction	67	investigate motion on a roller coaster
						67	set up the straight track
						82	plan three experiments to determine which variable affects the period of a pendulum
						82	design an experiment
		85	design and test a way to increase natural frequency				
		85	select appropriate technology to make measurements				
		129	choose circuit parts to light a bulb				
		201	design a procedure to separate a mixture				
		201	determine the equipment you will need				
		202	conduct your experiment				

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
I.1.1.03 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.	Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, and microscopes).	<p>data tables and graphs can be created on computer or graphing calculator</p> <p>18 measuring distance</p> <p>23 reading a digital timer</p> <p>25 accuracy and precision of measurements</p> <p>91 the force platform</p> <p>383 using a multimeter to measure voltage</p> <p>385 measuring current with an ammeter or multimeter</p> <p>387 using a multimeter to measure resistance</p> <p>504 Celsius and Fahrenheit thermometers</p> <p>505 how thermometers work</p>	<p>1 estimating length</p> <p>4 using a timer</p> <p>5 using photogates</p> <p>6 accuracy and resolution and printing</p> <p>7 using devices to measure mass</p> <p>9 using timer and photogates</p> <p>11 using timer and photogates</p> <p>14 using a timer and photogates</p> <p>17 using a timer and photogates</p> <p>18 use a timer and photogates</p> <p>21 plan the experiment</p> <p>21 use a timer and photogates</p> <p>21 conduct the experiment</p> <p>23 use a timer and photogates</p> <p>26 use a timer and photogates</p> <p>28 set up the ultimate pulley</p> <p>29 use a spring scale</p>

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					29 find mass
					34 use a spring scale
					42 use a timer and photogates
					43 measure and record the distance
					44 use a spring scale
					47 use a timer and photogate
					50 use a timer and photogate
					58 use a timer and photogate
					60 use a spring scale
					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 use a timer and photogate
					82 measure the length of the string
					85 select appropriate technology to make measurements

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					85 design and test a way to increase natural frequency
					87 use photogate and timer to measure the period
					89 use a spring scale to measure tension of string
					90 use a timer and photogates
					106 experiment with mirrors
					112 study reflection with a mirror
					115 use mirrors and lenses to learn how images are formed
					129 choose circuit parts to light a bulb
					131 use a multimeter to measure current
					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

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					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 192 use a digital balance 192 check the pressure with your gauge 201 determine the equipment you will need 202 conduct your experiment

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.1.1.04 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.	Convey results of investigations using scientific concepts, methodologies, and expressions.	2	understanding natural laws	12	cause and effect relationships
				3	connecting cause and effect through observation	12	was this experiment better or worse than the first?
				7	revising explanations through observation	13	create a graph
				8	refining theories based on observations	13	is there a trend in measurements?
				9	connecting cause and effect through analysis	16	create a graph
				10	the usefulness of phlogiston theory despite being incorrect	16	describe the graph
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	16	what do the results tell you?
						18	are the accelerations different?
						18	propose one way to increase acceleration
				42	writing lab procedures	19	does the ball accelerate?
				43	graphs are a way of representing data	22	create graphs
				43	constructing a graph	22	uniform acceleration model
				44	graphical models	25	create an algebraic model
				44	checking a graphical model's accuracy	28	solve second law equation for string tension
				45	recognizing patterns and cause and effect relationships	32	develop a model that predicts acceleration
						37	make a graph
45	recognizing patterns using graphs	38	make a graph				

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				54	understanding patterns in relationships between variables	43	create algebraic model
				54	constructing a graph	43	write a procedure
				55	create a graph from a data table	43	perform experiment
				55	create a graph from a data table	43	sketch four graphs
				56	indicate relationships between variables in graphs	43	what would happen if...?
				56	indicate relationships between variables in graphs	49	write a formula
				60	creating the acceleration formula from experiments	56	create a graph
				60	creating the acceleration formula from experiments	58	explain why the angular acceleration is different
				66	developing the formulas for a model of motion with constant acceleration	63	as mechanical advantage increases what happens to length of pulled string?
				71	parachutes and air resistance	65	investigate motion on a roller coaster
				103	evaluating perpetual motion claims	66	create a graph of speed vs. position
				242	finding a basic cycle of harmonic motion	66	what does the graph tell you?
				246	understanding graphs of harmonic motion	67	investigate motion on a roller coaster
				282	write a formula relating velocity of wave to period and wavelength	80	explain your observations
				282	write a formula relating velocity of wave to period and wavelength	82	analyze data
				290	the process of digital sound reproduction	82	make three different graphs
				304	comparison of wave forms from guitar sounds	87	explain how force applied causes the response
				304	comparison of wave forms from guitar sounds	87	sketch a graph

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				306 explain why hearing can be damaged by loud sounds	90 what effect does changing the tension have?
				307 decibel level vs. frequency graph for human hearing	90 explain why higher tension makes waves move faster
				312 light intensity follows an inverse square law	92 explain how wind might cause big waves in water
				411 the waveform of AC electricity	94 give an equation that describes your observations
				427 diagramming electric fields using field lines	97 did the method give an accurate result?
				443 diagramming magnetic fields using magnetic field lines	97 reliability of a double-blind test
				456 an experiment with a wire and compass	109 explain how the colored filters work
				463 building an electromagnet with wire and a nail	132 what conclusions can you draw?
				467 experiment demonstrating electromagnetic induction	133 analyze data and explain a rule
				479 current vs.voltage graph for a transistor	133 did battery voltage change?
					135 graph voltage vs. current
					136 graph voltage vs. current
					151 make a graph of voltage vs. time
					160 create a graph

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					<p>167 make a graph of voltage vs. number of magnets</p> <p>169 make a current vs. voltage graph for the diode</p> <p>175 display information you found for your element</p> <p>189 Bernoulli's equation</p> <p>201 develop a procedure</p> <p>202 keep detailed notes as you work</p> <p>202 would you modify your procedure further?</p> <p>204 build models of Na and Cl and use them to explain bonding</p>

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.1.1.05 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.	Understand how scientific theories are used to explain and predict natural phenomena (e.g., plate tectonics, ocean currents, structure of atom).	7	creating theories based on observations	13	predict speed of ball
				7	in science inquiry is used to uncover truth	18	how would acceleration be different?
				7	developing models to explain observations	22	model for uniform accelerated motion
				40	creating useful models	33	calculate the predicted speed
				101	a model for friction	37	use your graph to make a prediction
				102	a model for static friction	38	use your graph to make a prediction
				330	optics and optical instruments	42	predict exact landing location
				492	the binary number system and its use in computers	65	predict where the ball moves fastest
				498	since wood is created from other matter it must not be a fundamental substance	75	the discovery of atom's nucleus
				499	development of atomic theory	132	predict what the current will be
				560	deep water submarine Alvin application		
				644	proof of Einstein's theory of general relativity		
				645	astronomers find black holes by what is around them		

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I.I.II.01 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Understand how scientific process produce valid, reliable results.	7	in science inquiry is used to uncover truth	12	was this experiment better or worse than the first?
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	43	follow the scientific method
				44	checking a graphical model's accuracy	97	reliability of a double-blind test
				103	evaluating perpetual motion claims	97	did the method give an accurate result?
				560	deep water submarine Alvin application		
				644	proof of Einstein's theory of general relativity		
				645	astronomers find black holes by what is around them		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.I.II.02 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Use scientific reasoning and valid logic.	2	understanding natural laws	11	formulate a testable hypothesis
				3	inquiry starts with questions	12	cause and effect relationships
				3	using life experiences and common sense	12	was this experiment better or worse than the first?
				3	connecting cause and effect through observation	33	formulate a testable hypothesis
				4	inquiry through observation	43	perform experiment
				7	creating explanations through observation	43	test your prediction
				7	revising explanations through observation	48	formulate a hypothesis
				8	forming hypotheses and testing with experiments	65	form a hypothesis
				8	refining theories based on observations	65	investigate motion on a roller coaster
				8	formulating a hypothesis	65	where does the marble move the fastest?
				9	connecting cause and effect through analysis	67	investigate motion on a roller coaster
				10	putting forth ideas and then testing them	79	write a hypothesis
				10	the usefulness of phlogiston theory despite being incorrect	89	what is it that moves in the case of a wave?
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	90	what effect does changing the tension have?
		97	did the method give an accurate result?				
		97	reliability of a double-blind test				

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				44	checking a graphical model's accuracy	111	do your observations support this hypothesis?
				45	recognizing patterns and cause and effect relationships	147	how did A and B tapes acquire different charge?
				71	parachutes and air resistance	204	build models of Na and Cl and use them to explain bonding
				103	evaluating perpetual motion claims		
				242	finding a basic cycle of harmonic motion		
				323	using glow-in-the-dark plastic to demonstrate photon energy levels		
				423	charge by friction		
				456	an experiment with a wire and compass		
				463	building an electromagnet with wire and a nail		
				467	experiment demonstrating electromagnetic induction		

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Standard #: Strand	Standard	Benchmark	Performance Standard		Volume One Student Text Page	Volume Two Investigation Manual Page
I.I.II.03 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Understand how new data and observations can result in new scientific knowledge.	7	revising explanations through observation	12 was this experiment better or worse than the first?  97 reliability of a double-blind test  97 did the method give an accurate result?
				8	refining theories based on observations	
				11	acceptance of the Copernican model of the solar system on the basis of scientific evidence	
				44	checking a graphical model's accuracy	
				103	evaluating perpetual motion claims	
				641	research on future of the universe	
I.I.II.04 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Critically analyze an accepted explanation by reviewing current scientific knowledge.	8	Comparing a theory and a natural law	12 do your results agree with hypothesis?  33 does your experiment confirm your hypothesis?  50 does your experiment provide confirmation?  66 does this agree with your hypothesis?  111 how does what you observed support the quantum theory?
				8	testing hypotheses with experiments	
				136	determining formula for acceleration on a ramp	
				188	perpetual motion machines	
				367	speed of light did not behave as expected for Michelson and Morley	
				369	proof of time dilation	
				375	explain Thomas Young's demonstration of the wave nature of light	

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I.I.II.05 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe).	314	Einstein's theory of relativity	127 when does special relativity become important?
				366	relationship between matter and energy and time and space	
				367	speed of light paradox	
				368	speed and time and clocks	
				369	consequences of time dilation	
				371	simultaneity depends on the relative motion of your frame of reference	
				440	scientists have never found single magnetic poles	
				568	understanding how gravity works inside atoms	
				583	the meaning of the uncertainty principle	
				637	areas of active research in physics	
				639	the big bang	
				640	unresolved questions of history of universe	
				641	research on future of the universe	
641	research on future of the universe					

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				642 Einstein's theory and gravity and inertial mass	
				644 general relativity and curved space-time	
				645 black holes and general relativity	

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.I.II.06 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.	Examine the scientific processes and logic used in investigations of past events, investigations that can be planned in advance but are only done once, and investigations of phenomena that can be repeated easily and frequently.	7	in science inquiry is used to uncover truth	43	perform experiment
				9	testing ideas against scientific evidence	65	investigate motion on a roller coaster
				242	finding a basic cycle of harmonic motion	65	studying motion of ball on loop track
				293	demonstrating the Doppler effect	67	investigate motion on a roller coaster
				432	making a simple capacitor	82	plan three experiments to determine which variable affects the period of a pendulum
				456	an experiment with a wire and compass	82	design an experiment
				463	building an electromagnet with wire and a nail	201	determine the equipment you will need
				467	experiment demonstrating electromagnetic induction	201	design a procedure to separate a mixture
				560	deep water submarine Alvin application		
				641	research on future of the universe		
				644	proof of Einstein's theory of general relativity		
				645	astronomers find black holes by what is around them		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
I.I.III.01 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	Create multiple displays of data to analyze and explain the relationships in scientific investigations.		13 create a graph
					15 record data in a table
					16 create a graph
				43	16 describe the graph
				44	17 use a data table
				54	18 record data
				55	21 record results in table
				60	22 uniform acceleration model
				66	22 create graphs
					25 create an algebraic model
					27 record position and time data
				142	28 solve second law equation for string tension
				282	29 record mass and force
				290	32 develop a model that predicts acceleration
				312	37 make a graph
	38 make a graph				
	43 sketch four graphs				
411	43 create algebraic model				
	49 write a formula				
	56 create a graph				
	66 record data in table				

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					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
					87 sketch a graph
					94 give an equation that describes your observations
					135 graph voltage vs. current
					136 graph voltage vs. current
					151 make a graph of voltage vs. time
					160 create a graph
					167 make a graph of voltage vs. number of magnets
					169 make a current vs. voltage graph for the diode
					189 Bernoulli's equation

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I.1.III.02 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	Use mathematical models to describe, explain, and predict natural phenomena.	11	Ptolemy model vs. Copernicus model of the solar system	13	compare prediction to measurement
				40	making a good model	22	uniform acceleration model
				43	graphs are a way of representing data	22	how do you measured positions compare to model?
				44	using a graphical model to make a prediction and checking the model's accuracy	22	compare calculation with graph estimate
				45	recognizing patterns using graphs	25	create an algebraic model
				54	understanding patterns in relationships between variables	28	solve second law equation for string tension
				56	indicate relationships between variables in graphs	29	does experiment agree with prediction?
				60	creating the acceleration formula from experiments	32	develop a model that predicts acceleration
				66	developing the formulas for a model of motion with constant acceleration	43	create algebraic model
				246	understanding graphs of harmonic motion	43	how does the measurement compare to your prediction?
				282	write a formula relating velocity of wave to period and wavelength	49	write a formula
				297	frequency spectrum	76	compare predicted mass to actual mass
						94	give an equation that describes your observations
		114	are there differences between your prediction and measurement?				

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				304 comparison of wave forms from guitar sounds	189 Bernoulli's equation
				307 decibel level vs. frequency graph for human hearing	
				312 light intensity follows an inverse square law	
				427 diagramming electric fields using field lines	
				443 diagramming magnetic fields using magnetic field lines	
				479 current vs.voltage graph for a transistor	

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I.I.III.03 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	Use technologies to quantify relationships in scientific hypotheses.	18	measuring distance	1	estimating length
				25	accuracy and precision of measurements	6	accuracy and resolution and printing
				242	finding a basic cycle of harmonic motion	21	conduct the experiment
				456	an experiment with a wire and compass	21	plan the experiment
				463	building an electromagnet with wire and a nail	43	perform experiment
				463	building an electromagnet with wire and a nail	43	measure and record the distance
				467	experiment demonstrating electromagnetic induction	60	measure input and output forces
				467	experiment demonstrating electromagnetic induction	65	investigate motion on a roller coaster
				467	experiment demonstrating electromagnetic induction	67	investigate motion on a roller coaster
				467	experiment demonstrating electromagnetic induction	67	measure vertical distance
				82	measure the length of the string		
						85	select appropriate technology to make measurements
						129	choose circuit parts to light a bulb

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I.I.III.04 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	Identify and apply measurement techniques and consider possible effects of measurement errors.	18	measuring distance	1	estimating length
				25	why accuracy and precision are important	6	collecting data with precision
				25	accuracy and precision of measurements	6	accuracy and resolution and printing
				42	controlling variables in experiments	15	collect time data with precision
						18	collect time data with precision
						43	discuss sources of error
						43	measure and record the distance
						45	discuss sources of errors
		60	measure input and output forces				
		67	measure vertical distance				
		82	measure the length of the string				
		202	identify two sources of experimental error				

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

#### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
I.1.III.05 Scientific Thinking and Practice	Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.	Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.	Use mathematics to express and establish scientific relationships.	43	graphs are a way of representing data	22	uniform acceleration model
				45	recognizing patterns using graphs	25	create an algebraic model
				54	understanding patterns in relationships between variables	28	solve second law equation for string tension
				56	indicate relationships between variables in graphs	32	develop a model that predicts acceleration
				60	creating the acceleration formula from experiments	43	create algebraic model
				66	developing the formulas for a model of motion with constant acceleration	49	write a formula
				246	understanding graphs of harmonic motion	94	give an equation that describes your observations
				282	write a formula relating velocity of wave to period and wavelength	189	Bernoulli's equation
				304	comparison of wave forms from guitar sounds		
				307	decibel level vs. frequency graph for human hearing		
				312	light intensity follows an inverse square law		
				427	diagramming electric fields using field lines		

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				443 diagramming magnetic fields using magnetic field lines 479 current vs.voltage graph for a transistor	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.II.01 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Identify different forms of energy, including kinetic, gravitational, chemical, thermal, nuclear, and electromagnetic.	189	energy appears in different forms	68	calculate potential and kinetic energy
				190	different forms of energy	72	potential to kinetic energy conversion in a pendulum
				191	the formula for potential energy	88	potential to kinetic energy conversions of a pendulum
				192	the formula for kinetic energy		
				193	deriving the formula for kinetic energy		
				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		
				212	understand basic forms of energy		
				245	kinetic to potential energy changes in motion of an oscillator		
				253	harmonic motion involves both potential and kinetic energy		
				253	oscillators exchange energy back and forth between potential and kinetic		
310	light is a form of energy						

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				322 photons are bundles of light energy	
				378 electrical energy	
				384 batteries use chemical energy	
				552 explanation of pressure and energy	
				597 the energy of chemical bonds is described	
				619 radiation as a flow of energy	
				622 energy of x-rays	
				625 energy changes in nuclear reactions	
				626 source of energy in nuclear reactions	
				627 energy of fusion reactions	
				628 energy of fission reactions	
				647 energy from antimatter	

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.1.II.02 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Explain how thermal energy (heat) consists of the random motion and vibrations of atoms and molecules and is measured by temperature.	506 temperature measures average kinetic energy 509 heat of fusion 510 heat of vaporization 511 evaporation and condensation 520 relationship between temp and average kinetic energy 606 energy from sunlight stored through photosynthesis	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.II.03 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Understand that energy can change from one form to another and know that energy is conserved in these changes.	190	conversions of energy	66	law of conservation of energy
				194	the law of conservation of energy	68	find the total energy at each position
				194	energy transformations	72	draw an energy flow diagram
				194	conservation of energy explained	74	investigating collisions and conservation of energy
				195	applying conservation of energy for a marble rolling on a hilly track		
				195	conservation of energy in a closed system		
				196	energy transformation hydroelectric plant		
				197	conservation of energy for Hoover Dam		
				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		

Correlation to New Mexico Science Content Standards, 9th - 12th grade

*Foundations of Physics*

Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				219 energy flow of a model solar car	
				227 kinetic energy conservation for elastic collisions	
				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	

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				464 electric motor uses electromagnets to convert electrical energy to mechanical energy	
				467 electric generators transform mechanical energy into electric 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	
				629 conservation of energy in nuclear reactions	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page	
II.1.II.04 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Understand how heat can be transferred by conduction, convection, and radiation, and how heat conduction differs in conductors and insulators.	522	heat conduction	182 observe free and forced convection  182 investigate convection in a liquid  184 explore properties of thermal radiation
				523	heat conduction	
				524	conduction in solids	
				524	conduction in solids and liquids and gases	
				525	the heat conduction equation	
				526	convection	
				526	free and forced convection	
				526	convection in liquids	
				526	convection	
				527	convection depends on speed and surface area	
				528	convection and weather	
				529	heat transfer coefficient and the convection equation	
				530	radiation	
				533	Stefan-Boltzmann formula	
				535	sources of heat transfer in buildings	
				538	using heat conduction equation to calculate R- value	
				538	convection equation problem	

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

<b>Standard #: Strand</b>	<b>Standard</b>	<b>Benchmark</b>	<b>Performance Standard</b>	<b>Volume One Student Text Page</b>	<b>Volume Two Investigation Manual Page</b>
II.1.II.05 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions.	509 temperature change and thermal energy 512 temperature and thermal energy and heat 513 transfer of thermal energy 513 balance of thermal energy 522 thermal equilibrium 523 thermal conductors and insulators 537 heat flow between objects of different temperature	178 explore the connection between temperature and heat and energy

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.1.II.06 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Understand that the ability of energy to do something useful (work) tends to decrease as energy is converted from one form to another.	190 conversions of energy 194 energy transformations 195 friction can divert some energy 196 energy transformation hydroelectric plant 202 efficiency and energy conversions 203 how friction affects machines 205 efficiency in biological systems 206 friction and the arrow of time 212 energy conversion 213 the conversion process of energy flow 216 tidal energy represents frictional energy from the Earth-moon system 219 energy flow of a model solar car 245 friction causes damping in oscillators 256 resonant systems accumulate energy 277 waves propagate by exchanging energy between two forms	67 friction as a source of energy dissipation 72 draw an energy flow diagram

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				320	
				324	
				356	
				393	
				400	
				451	
				464	
				467	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.1.II.07 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Understand that electromagnetic waves carry energy that can be transferred when they interact with matter.	262 waves transmit energy 263 waves are a form of traveling energy 272 waves transfer energy through absorption 277 energy of a wave 310 light is a form of energy 312 the intensity of light 313 light carries information 314 the speed of light 322 the photon theory of light 323 photons and the intensity of light 324 when the photon theory of light is useful 328 how is light used for communication? 356 light can be described in terms of waves 357 frequency and wavelength of light 358 speed of light is frequency multiplied by length 373 wave fronts of light 530 energy and radiation relationships	95 waves carry energy from one place to another 111 photons and quantum theory

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				581 quantum or photon theory of light	

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### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.II.08 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Describe the characteristics of electromagnetic waves and other waves.	264	frequency and amplitude and wavelength in waves	88	if frequency is increased what happens to total energy?
				264	basic properties of frequency and wavelength and amplitude	89	study characteristics of a wave pulse on a string
				265	concept of speed of a wave	90	measure speed of a wave pulse
				266	formula for speed of a wave	90	study the speed of the wave pulse
				267	transverse and longitudinal waves	91	is your water wave transverse or longitudinal?
				268	creating plane waves and circular waves	93	investigate frequency and wavelength
				277	energy of a wave is proportional to frequency and amplitude	94	investigate the wavelength of standing waves
				278	modes of a wave	94	investigate the frequency of standing waves
				278	wavelength of a standing wave	122	study properties of the electromagnetic spectrum
				279	modes of vibration	125	study the polarization of a transverse spring wave
				281	microwaves		
				282	describe relationship between wave characteristics		
				283	type of wave represented by a spring		
				286	properties of sound waves		
				287	frequency and pitch of sound		

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				288	
					relationship of loudness and amplitude and pressure in sound wave
				291	
					pressure and amplitude of sound waves
				292	
					frequency and wavelengths of sound
				292	
					sound is a longitudinal wave
				292	
					importance of wavelength of sound waves
				300	
					pitch and frequency in music
				303	
					design of a guitar
				308	
					wave amplitude and harmonics of tuning fork and musical instrument
				311	
					fluorescent bulbs create UV light
				320	
					visible light has just the right energy for life
				320	
					the energy of IR and UV light
				359	
					waves of the electromagnetic spectrum
				359	
					description and examples of infrared waves
				360	
					visible light waves

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				360 description and examples of ultraviolet waves	
				531 thermal radiation and infrared light	
				624 UV light is ionizing radiation	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.II.09 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Know that each kind of atom or molecule can gain or lose energy only in discrete amounts.	310	how we see	111	photons and quantum theory
				317	how the human eye sees color	120	apply the concept of chromatic aberration
				318	how we perceive color	197	quantum theory and electrons
				319	we see mostly reflected light		
				322	the photon theory of light		
				323	photons and the intensity of light		
				324	the process of how light is reflected		
				324	when the photon theory of light is useful		
				345	chromatic aberration and spherical aberration		
				576	quantum states		
				577	energy levels and quantum states		
				578	quantum state holds one electron		
				579	quantum states are called orbitals in chemistry		
				581	quantum or photon theory of light		
				582	quantum theory		
584	quantum theory and probability						

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				588 quantum states and energy levels	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.I.II.10 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Explain how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and the composition of stars.	362	diffraction patterns and the spectrometer	110	all light is produced by atoms
				574	emission/absorption spectrum	197	quantum theory and electrons
				574	Neils Bohr's theory	197	absorption and emission of light by atomic electrons
				575	spectral analysis of the sun	203	electrons and energy levels
				575	spectrum of hydrogen		
				575	using the Balmer formula		
				576	quantum numbers and the Balmer formula		
				576	quantum states		
				576	Neils Bohr		
				577	energy levels and quantum states		
				577	Balmer's formula and energy levels		
				577	energy levels explain spectral lines		
				578	quantum state holds one electron		
				579	quantum states are called orbitals in chemistry		
				582	quantum theory		
				584	quantum theory and probability		
588	quantum states and energy levels						

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				638 spectral-line patterns and red shift	

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### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.I.II.11 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the transformation and transmission of energy and how energy and matter interact.	Understand the concept of equilibrium.	86	zero net force in equilibrium	44	forces in equilibrium
				99	weight in equilibrium problems	54	explore rotational equilibrium and net torque
				106	definition of equilibrium	84	restoring forces and equilibrium
				108	applications of equilibrium		
				109	restoring force of a spring		
				110	restoring force of a spring		
				110	Hooke's law and restoring force of a spring		
				111	solid materials exert restoring force		
				111	equilibrium and reaction or normal forces		
				115	understanding of equilibrium		
				133	equilibrium of forces and balancing forces		
				162	combining torques to find the net torque		
				163	in rotational equilibrium the net torque is zero		
				163	rotational equilibrium		
				175	explain rotational equilibrium		
214	steady state energy balance of Earth						

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

***Foundations of Physics***

**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				248 harmonic motion and equilibrium	
				250 stable and unstable equilibrium	
				251 restoring forces and inertia affect natural frequency	
				264 equilibrium level of waves	
				522 thermal equilibrium	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.1.III.01 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Know that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force.	68 free fall and acceleration due to gravity 69 motion formulas for free fall 70 solving problems with free fall 71 acceleration of gravity does not depend on mass 75 problem understanding acceleration due to gravity 97 strength of gravity on Earth and Jupiter 98 gravity and acceleration and weightlessness 124 projectiles and trajectories 128 gravity only accelerates vertical motion 129 vertical motion of a projectile 130 projectiles launched at an angle 131 range of projectiles 134 resolving force of gravity in ramp coordinates 135 acceleration down an inclined plane 141 effects of gravity on motion of a projectile	23 investigate the effect of gravity

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				152 law of universal gravitation and orbital motion	
				154 orbits and gravitational force	
				155 centripetal force and the law of universal gravitation combine to form the orbit equation	
				158 compare projectile motion to orbital motion	
				165 the motion of a tossed object	
				166 centers of mass and gravity may differ	
				187 work done against gravity	
				191 potential energy comes from gravity	
				568 forces in the atom	
				626 strong force and electromagnetic force in the nucleus	
				649 four forces in nature	

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.02 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Know that every object exerts gravitational force on every other object, and how this force depends on the masses of the objects and the distance between them.	68	free fall and acceleration due to gravity	23	investigate the effect of gravity
				69	motion formulas for free fall	51	calculate gravitational force of attraction
				70	solving problems with free fall	51	investigate law of universal gravitation
				71	acceleration of gravity does not depend on mass		
				75	problem understanding acceleration due to gravity		
				97	strength of gravity on Earth and Jupiter		
				98	gravity and acceleration and weightlessness		
				124	projectiles and trajectories		
				128	gravity only accelerates vertical motion		
				129	vertical motion of a projectile		
				130	projectiles launched at an angle		
				131	range of projectiles		
				134	resolving force of gravity in ramp coordinates		
				135	acceleration down an inclined plane		
141	effects of gravity on motion of a projectile						

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				152	
					law of universal gravitation and orbital motion
				152	
					description of law of universal gravitation
				153	
					formula and calculations for law of universal gravitation
				154	
					orbits and gravitational force
				154	
					orbital motion
				154	
					satellites and orbital motion
				155	
					centripetal force and the law of universal gravitation combine to form the orbit equation
				155	
					satellite motion application
				156	
					HEO and geostationary orbit
				158	
					calculate weight and acceleration due to gravity on Pluto
				158	
					compare projectile motion to orbital motion
				165	
					the motion of a tossed object
				166	
					centers of mass and gravity may differ

**Correlation to New Mexico Science Content Standards, 9th - 12th grade**

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				187 work done against gravity	
				191 potential energy comes from gravity	
				216 tides are due to force of gravity	
				243 orbit is a type of cycle	
				642 Newton's laws and gravity	

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#### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.03 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Know that materials containing equal amounts of positive and negative charges are electrically neutral, but that a small excess or deficit of negative charges produces significant electrical forces.	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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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				441 comparing magnetic and electric forces	
				442 force between two magnetics is not an inverse square law	
				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	
				588 properties of subatomic particles	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.05 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Explain how electric currents cause magnetism and how changing magnetic fields produce electricity.	356	electricity and magnetism oscillations	159	build an electromagnet
				435	steering the electron beam on television screen	160	find out what happens to strength of electromagnet when current is increased
				456	magnetic field of a wire	160	what happens to the strength of an electromagnet when you increase the current?
				457	force on a current in a magnetic field		
				458	coils and solenoids	165	investigate Faraday's law of induction
				459	the magnetic field of coils and permanent magnets	165	investigate electromagnetic induction
				461	calculate magnetic field at the center of a coil		
				462	electromagnets		
				462	coils used in electromagnets		
				463	building an electromagnet		
				463	adding turns increases an electromagnet's strength		
				464	electric motor uses electromagnets to convert electrical energy to mechanical energy		
				465	how electromagnets are used in electric motors		
				467	concept of electromagnetic induction		
				468	magnetic flux		
				469	Faraday's law of induction		

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				471 transformers operate on electromagnetic induction	
				472 electromagnet-based maglev	
				473 Eddy currents	
				475 diagram of electromagnet	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.06 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Represent the magnitude and direction of forces by vector diagrams.	119	adding vectors	41	calculate the resultant vector
				120	adding vectors	44	investigating force vectors
				121	adding and subtracting vectors	45	calculate force components
				122	calculating vector components	49	draw a free body diagram and label forces
				123	finding magnitude and angle of a vector		
				125	the velocity vector		
				126	components of the velocity vector		
				127	adding velocity vectors		
				128	independence of horizontal and vertical motion in a velocity vector		
				130	calculating velocity components of initial velocity		
				132	interpreting the x-y components of force		
				132	the force vector describes the strength and direction of a force		
				133	calculating components of a force vector		
				136	calculate the acceleration of a skier on a slope		
				186	work done by a force at an angle to the distance		

## Correlation to New Mexico Science Content Standards, 9th - 12th grade

### *Foundations of Physics*

### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.07 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Know that when one object exerts a force on a second object, the second object exerts a force of equal magnitude and in the opposite direction on the first object.	87	forces always occur in action-reaction pairs	30	Newton's third law and free body diagrams
				88	Newton's third law operates on pairs of objects	30	investigate Newton's third law
				89	solving problems with action-reaction forces	31	draw free body diagrams and identify action- reaction pairs
				89	identifying which force is acting on which object	78	which ball had a greater change in momentum?
				102	the normal force as the reaction in an action- reaction pair		
				107	forces on a free-body diagram		
				111	understanding reaction forces in terms of springs and deformation		
				112	analysis of forces on a bridge		
				135	normal force of an inclined plane		
				224	momentum and Newton's third law		
				224	law of conservation of momentum		
				225	conservation of momentum in collisions		
				226	applying conservation of momentum		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				227	
					momentum conservation for collisions in two and three dimensions
				231	
					conservation of angular momentum examples
				232	
					conservation of angular momentum
				235	
					jet engines work because of conservation of momentum
				370	
					Einstein's thinking about momentum of particles moving near the speed of light
				425	
					electric forces always occur in pairs according to Newton's third law
				548	
					Newton's third law and pressure in a fluid
				550	
					pressure and the third law
				557	
					pressure of gases
				629	
					conservation of momentum in nuclear reactions

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.1.III.08 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Apply Newton's Laws to describe and analyze the behavior of moving objects.	61	any acceleration must come from a force	26	collect data on Newton's first law
				78	changes in motion only occur through force	26	study Newton's first law
				79	all objects tend to resist changes in motion	27	explain how Newton's first law applies
				80	Newton's laws and cup holders	28	investigate Newton's second law
				81	Newton's second law of motion	30	Newton's third law and free body diagrams
				83	calculation using Newton's second law	30	investigate Newton's third law
				84	Newton's second law and dynamics problems	31	draw free body diagrams and identify action- reaction pairs
				85	force problems	77	relationship between force and motion and the second law
				85	if there is acceleration there must be force		
				85	finding force from acceleration		
				87	forces always occur in action-reaction pairs		
				88	Newton's third law operates on pairs of objects		
				89	solving problems with action-reaction forces		
				89	identifying which force is acting on which object		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				93	
				93	
				94	
				102	
				106	
				107	
				108	
				108	
				111	
				112	
				116	
				135	
				136	
				137	
				137	

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				148	
				direction of force determines linear or rotational motion	
				149	
				calculating centripetal force	
				150	
				formula for centripetal acceleration	
				155	
				satellite motion application	
				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	
				222	
				Newton's first law and momentum	
				224	
				momentum and Newton's third law	
				228	
				Newton's second law relating force and momentum	
				229	
				momentum form of Newton's second law	
				240	
				forces in a car stopping	
				252	
				Newton's second law and natural frequency	

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				425 electric forces always occur in pairs according to Newton's third law	
				548 Newton's third law and pressure in a fluid	
				550 pressure and the third law	
				557 pressure of gases	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.1.III.09 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Describe relative motion using frames of reference.	36 speed is relative 75 problem using frames of reference 127 calculating velocity vectors may require knowing frames of reference 314 Einstein's theory of relativity 366 special relativity and time dilation 366 relationship between matter and energy and time and space 367 speed of light paradox 367 relative motion and speed of light 368 speed and time and clocks 369 frequency of light depends on relative motion 369 consequences of time dilation 371 simultaneity depends on the relative motion of your frame of reference 371 simultaneity depends on the relative motion of your frame of reference	127 when does special relativity become important? 128 relativity and frames of reference

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				642 Einstein's theory and gravity and inertial mass	
				643 frame of reference and the equivalence principle	
				644 general relativity and curved space-time	
				645 black holes and general relativity	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.I.III.10 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Describe wave propagation using amplitude, wavelength, frequency, and speed.	242	what is a cycle?	81	investigate the motion of a pendulum
				244	concepts of period and frequency explained	88	if frequency is increased what happens to total energy?
				245	concept of amplitude explained	89	study characteristics of a wave pulse on a string
				249	analyze the motion of the cycle of a pendulum	90	measure speed of a wave pulse
				251	systems tends to have a preferred frequency	90	study the speed of the wave pulse
				258	identify period and frequency and cycle and amplitude	91	is your water wave transverse or longitudinal?
				260	calculate speed of an oscillator	93	investigate frequency and wavelength
				264	frequency and amplitude and wavelength in waves	94	investigate the wavelength of standing waves
				264	basic properties of frequency and wavelength and amplitude	94	investigate the frequency of standing waves
				265	concept of speed of a wave	124	use a spectrometer to measure wavelength of different colors of light
				266	formula for speed of a wave	125	study the polarization of a transverse spring wave
				266	speed of a wave is the speed at which a cycle moves		
				267	transverse and longitudinal waves		
				268	creating plane waves and circular waves		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				277 energy of a wave is proportional to frequency and amplitude	
				278 modes of a wave	
				278 wavelength of a standing wave	
				279 modes of vibration	
				281 microwaves	
				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	
				287 frequency and pitch of sound	
				288 relationship of loudness and amplitude and pressure in sound wave	
				291 pressure and amplitude of sound waves	
				292 sound is a longitudinal wave	
				292 importance of wavelength of sound waves	
				292 frequency and wavelengths of sound	

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				300	
				pitch and frequency in music	
				303	
				design of a guitar	
				308	
				wave amplitude and harmonics of tuning fork and musical instrument	
				310	
				light is a form of energy	
				312	
				the intensity of light	
				313	
				light carries information	
				314	
				the speed of light	
				328	
				how is light used for communication?	
				356	
				light can be described in terms of waves	
				357	
				relationship between frequency and energy and color of light	
				357	
				frequency and wavelength of light	
				358	
				speed of light is frequency multiplied by length	
				359	
				waves of the electromagnetic spectrum	
				373	
				wave fronts of light	
				375	
				relate color to frequency for visible light	
				452	
				MRI--each nucleus is a resonant oscillator	

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				530 electromagnetic radiation	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page		
II.I.III.11 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Explain how the interactions of waves can result in interference, reflection, and refraction.	270	waves and reflection	92	observing reflection in water waves
				270	waves and absorption	92	investigate reflection in a ripple tank
				270	waves and diffraction	92	investigate diffraction in a ripple tank
				270	waves and refraction	101	investigate interference with sound waves
				271	waves and reflection and boundaries	106	study refraction in a prism
				271	waves and refraction and boundaries	106	study reflection in a prism
				272	waves and diffraction and boundaries	113	study how refraction works
				272	waves and absorption and boundaries	123	study light interference
				273	constructive and destructive interference	123	study light diffraction patterns
				273	sound and light waves and interference		
				274	resonance and reflection		
				278	nodes and antinodes		
				295	standing wave patterns of sound		
				296	interference of sound waves		
				301	consonance and dissonance and beats		
				306	beats in a musical sound		
				310	how we see		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				315	
					light rays bounce off a surface
				315	
					light bends as it moves into a material
				317	
					how the human eye sees color
				318	
					how we perceive color
				319	
					we see mostly reflected light
				324	
					the process of how light is reflected
				324	
					the process of how light is reflected
				332	
					specular and diffuse reflection
				333	
					finding the normal line for reflection
				334	
					refraction is the bending of light rays
				336	
					total internal reflection and the critical angle
				339	
					the image formed in a mirror
				340	
					design of a lens
				345	
					diffraction spot size image defect
				356	
					electromagnetic waves are oscillations of an energy field

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				361 interference of light waves and Young's double-slit experiment	
				362 diffraction grating	
				373 holograms and the interference of light	
				530 absorption of thermal radiation	
				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	

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### Student Text and Investigation Manual

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
II.I.III.12 The Content of Science	Physical Science: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.	Understand the motion of objects and waves, and the forces that cause them.	Describe how waves are used for practical purposes.	262 waves are all around us 265 wave pulse 267 water waves are transverse and Slinky is longitudinal 268 one- and two- and three- dimensional waves 275 standing waves on a string 277 standing waves on a string 277 standing waves are used to store energy 279 vibration of a drum 281 use of microwaves in microwave ovens 281 microwaves 286 sound is a wave of pressure 289 acoustics 289 vibrations create sound 291 how we know sound is a wave 294 effect of medium and temperature on speed of sound wave 295 designing a musical instrument	89 making wave pulses on a string 89 study wave pulses on elastic cord 91 making circular waves in a ripple tank 91 make different types of waves in a ripple tank 91 making plane waves in a ripple tank 96 investigate human perception of sound 106 use a mirror to study how light behaves 121 study the thin lens formula 122 study properties of the electromagnetic spectrum

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				296	
					design of a good concert hall
				298	sonograms
				301	echolocation and beats
				302	musical instruments
				303	sound from a guitar
				306	list evidence that sound is a wave
				310	how we see
				311	fluorescent bulbs create UV light
				315	mirrors
				317	how the human eye sees color
				318	how we perceive color
				319	we see mostly reflected light
				320	visible light has just the right energy for life
				320	the energy of IR and UV light
				324	the process of how light is reflected
				331	lenses bend light
				331	mirrors reflect light
				332	the image in a mirror
				336	how fiber optics work

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**Student Text and Investigation Manual**

Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
				338	
					how the human eye sees images
				346	
					thin lens formula
				353	
					explain fiber optic cables
				359	
					waves of the electromagnetic spectrum
				359	
					descriptions of radio waves and microwaves and infrared rays
				359	
					description and examples of infrared waves
				360	
					visible light waves
				360	
					description and examples of ultraviolet waves
				360	
					x-rays and gamma rays
				362	
					the diffraction pattern of laser light
				372	
					three-dimensional images and the human eye
				376	
					fiber optic cable calculation
				452	
					MRI uses radio waves
				531	
					thermal radiation and infrared light
				585	
					laser application
				586	
					how lasers make light
				624	
					UV light is ionizing radiation