

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

Physics: A First Course

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.	6	what is a variable	6	design a better experiment
				8	scientific method	6	recognize and control variables
				8	cause and effect relationships	13	design other experiments
				8	control and experimental variables	15	design another experiment
				8	dependent variables	16	safety with simple machines
				8	independent variables	27	identify and control variables
				8	asking a scientific question	47	conduct the experiment you designed
				16	graphs and dependent variables	48	demonstrate safe lab practices
				16	graphs and independent variables	67	short circuits and lab safety
				22	scientific method in action	70	capacitor safety
24	importance of changing one variable at a time in an experiment	94	investigate variables and how they affect the period of a pendulum				
I.I.I.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.	4	what is an experiment	6	design a better experiment
				8	designing experiments	13	design other experiments
						15	design another experiment
						47	conduct the experiment you designed
						47	design an experiment
		94	design pendulum experiments				

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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).	11	measurement	computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation		
				12	metric system			
				13	measuring time			
				171	how a thermometer works			
				305	using a multimeter to measure current		2	using timers and photogates
				307	using a multimeter to measure resistance		6	design a better experiment
							13	design other experiments
							15	design another experiment
							22	use spring scales
							44	using a timer and photogates
46	using a timer and photogates							
47	conduct the experiment you designed							
59	use a multimeter							
61	using a multimeter to measure resistance	62	use a multimeter to measure current					
63	use a multimeter to measure resistance of a pot	64	use a multimeter to measure voltage drop					
65	use a multimeter to measure voltage							

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					66 use a multimeter to measure current 74 use a multimeter to measure voltage 85 use a multimeter to measure voltage 86 use a timer and photogate to measure speed of rotor 93 use a timer and photogate to measure the period of a pendulum 96 use a timer and photogate to measure the natural frequency of an oscillator 150 using computer spreadsheets

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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.	8	cause and effect relationships	4	construct a graph
				16	steps to follow for graph construction	6	reflecting on the experiment
				16	constructing graphs	6	do results agree with hypothesis?
				19	mathematical descriptions	7	construct explanations supported by evidence
				25	constructing a graph	9	how do your observations support your answer?
				26	interpreting distance/time graph	11	find formula for acceleration
				34	mathematical model of acceleration	11	create a graph
				35	Newton's second law equation	11	what experimental data support answer?
				41	average speed equation	13	derive a formula
				43	calculating weight	15	graph speed vs. height
				46	motion graphs	17	calculate mechanical advantage
				48	motion graphs	17	derive a formula to use with ropes and pulleys
				56	analyze a speed/distance graph	20	graph work done vs. deflection of rubber band
				61	momentum equation	21	graph speed vs. rubber band deflection
				62	relating impulse and momentum conservation	25	graph friction vs. mass
				68	kinetic energy formula	27	graph launch angle vs. range
				86	the work equation	29	find a mathematical name for the steepness ratio
89	the power equation						
96	calculating mechanical advantage						

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				112	using a graph to find force vector components	29	calculate the ratio
				118	Hooke's law equation	29	graph acceleration vs. steepness ratio
				141	projectile motion problems	31	calculate temperature of mixture
				143	calculating angular speed	45	make a graph of efficiency vs. speed
				144	finding the circumference of a circle	47	analyze the results
				145	linear speed equation	47	construct a reasonable explanation
				153	equation for law of universal gravitation	50	graph time vs. temperature
				179	the heat equation	52	construct a graph
				193	density formula	60	propose a relationship between power and voltage
				208	pressure and temperature relationship	69	calculate power used by the bulb
				308	equation for Ohm's law	75	derive a formula to calculate the charge
				342	equation for Coulomb's law	75	graph current vs. time for the capacitor
				419	harmonic motion graphs	76	calculate the number of electrons
				420	finding the amplitude on a harmonic motion graph	86	graph voltage vs. speed
				438	calculating wave speeds	94	sketch harmonic motion graphs
				439	equation for the speed of a wave	99	calculate natural frequency and period
				525	equation for the speed of light		

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Standard #: Strand	Standard	Benchmark	Performance Standard	Volume One Student Text Page	Volume Two Investigation Manual Page
					154 calculate gear ratio 154 create a report 154 analyze gear ratio data
I.I.I.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).	19 mathematical models 23 science helps us learn about natural world 167 history of atomic theory 218 atomic theory 219 development of atom models	6 predict fastest car 15 predict speed of car 21 predict speed of car 30 predict temperature of mixture 45 predict how many bounces the car will make 96 make predictions about natural frequency
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.	8 scientific method 22 scientific method in action 23 science helps us learn about natural world	

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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.	8 formulating a hypothesis 8 hypothesis defined 8 cause and effect relationships 8 asking a scientific question	6 form a hypothesis 6 do results agree with hypothesis? 30 state a hypothesis about the water's energy 94 state a hypothesis about period of pendulum 96 state a hypothesis about the natural frequency of the oscillator
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.		6 reflecting on the experiment 7 construct explanations supported by evidence 9 how do your observations support your answer? 11 what experimental data support answer? 47 construct a reasonable explanation 52 find a percentage 60 propose a relationship between power and voltage 61 collect and record resistance data

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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.	167 218 219	history of atomic theory atomic theory development of atom models	31	did result agree with hypothesis?
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).	104 122 284	prosthetic legs and technology maglev train technology theory of special relativity	53 55 112 161	explore the concept of relativity a thought experiment on Einstein's theories research how computer monitors and televisions make colros making a model maglev train
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.	4 8 23	what is an experiment designing experiments science helps us learn about natural world	6 13 15 47 94	design a better experiment design other experiments design another experiment design an experiment design pendulum experiments

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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.	16	constructing graphs	computer spreadsheets and graphing software can be used throughout the curriculum for data analysis and presentation		
				16	steps to follow for graph construction			
				19	mathematical descriptions			
				25	constructing a graph		4	construct a graph
				26	interpreting distance/time graph		6	use a data table
				34	mathematical model of acceleration		8	constant force data table
				34	mathematical model of acceleration		9	constant height data table
				35	Newton's second law equation		10	speed data table
				35	Newton's second law equation		11	create a graph
				41	average speed equation		11	find formula for acceleration
				43	calculating weight		13	collision data table
				46	motion graphs		13	derive a formula
				48	motion graphs		15	graph speed vs. height
				61	momentum equation		17	calculate mechanical advantage
				62	relating impulse and momentum conservation		17	derive a formula to use with ropes and pulleys
				68	kinetic energy formula		17	derive a formula to use with ropes and pulleys
				86	the work equation		18	output and input work data table
				89	the power equation		18	output and input work data table
96	calculating mechanical advantage	19	force vs. distance data table					
112	using a graph to find force vector components	20	graph work done vs. deflection of rubber band					
118	Hooke's law equation	21	graph speed vs. rubber band deflection					
141	projectile motion problems							

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				143	calculating angular speed	22	force data table
				144	finding the circumference of a circle	25	rolling friction data table
				145	linear speed equation	25	graph friction vs. mass
				153	equation for law of universal gravitation	27	graph launch angle vs. range
				179	the heat equation	29	speed and height data table
				193	density formula	29	graph acceleration vs. steepness ratio
				208	pressure and temperature relationship	29	calculate the ratio
				308	equation for Ohm's law	29	find a mathematical name for the steepness ratio
				342	equation for Coulomb's law	31	calculate temperature of mixture
				419	harmonic motion graphs	45	make a graph of efficiency vs. speed
				420	finding the amplitude on a harmonic motion graph	50	graph time vs. temperature
				438	calculating wave speeds	52	construct a graph
				439	equation for the speed of a wave	69	calculate power used by the bulb
				525	equation for the speed of light	75	graph current vs. time for the capacitor
						75	derive a formula to calculate the charge
						76	calculate the number of electrons
						86	graph voltage vs. speed

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					94 sketch harmonic motion graphs 99 calculate natural frequency and period 150 using computer spreadsheets 154 create a data table 154 calculate gear ratio

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I.I.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.	10	what is a model	11	find formula for acceleration
				19	mathematical descriptions	13	derive a formula
				26	interpreting distance/time graph	17	calculate mechanical advantage
				34	mathematical model of acceleration	17	derive a formula to use with ropes and pulleys
				35	Newton's second law equation	29	find a mathematical name for the steepness ratio
				41	average speed equation	29	calculate the ratio
				43	calculating weight	31	calculate temperature of mixture
				61	momentum equation	69	calculate power used by the bulb
				62	relating impulse and momentum conservation	75	derive a formula to calculate the charge
				68	kinetic energy formula	76	calculate the number of electrons
				86	the work equation	99	calculate natural frequency and period
				89	the power equation	154	calculate gear ratio
				96	calculating mechanical advantage		
				118	Hooke's law equation		
				141	projectile motion problems		
				143	calculating angular speed		
				144	finding the circumference of a circle		
				145	linear speed equation		
153	equation for law of universal gravitation						
179	the heat equation						

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				193 density formula	
				208 pressure and temperature relationship	
				308 equation for Ohm's law	
				342 equation for Coulomb's law	
				438 calculating wave speeds	
				439 equation for the speed of a wave	
				525 equation for the speed of light	

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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.	11 measurement 12 metric system 13 measuring time 305 using a multimeter to measure current 307 using a multimeter to measure resistance	2 using timers and photogates 44 using a timer and photogates 46 using a timer and photogates 59 use a multimeter 61 using a multimeter to measure resistance 62 use a multimeter to measure current 63 use a multimeter to measure resistance of a pot 64 use a multimeter to measure voltage drop 65 use a multimeter to measure voltage 66 use a multimeter to measure current 74 use a multimeter to measure voltage 85 use a multimeter to measure voltage 86 use a timer and photogate to measure speed of rotor 93 use a timer and photogate to measure the period of a pendulum

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					96 use a timer and photogate to measure the natural frequency of an oscillator
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.	11 measurement 12 metric system 13 measuring time	1 collect accurate, precise data with electronic timer 3 car launching technique is a possible source of error 4 car launching technique is a possible source of error 7 collect precise data 21 how close is your prediction to the actual measurement? 26 spotting the landing point of the marble is tricky 27 how can photogate ensure consistent results? 27 marble launching technique is a possible source of error 78 estimate the precision of measurements

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I.I.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.	19	mathematical descriptions	11	find formula for acceleration
				26	interpreting distance/time graph	13	derive a formula
				34	mathematical model of acceleration	17	calculate mechanical advantage
				35	Newton's second law equation	17	derive a formula to use with ropes and pulleys
				41	average speed equation	29	find a mathematical name for the steepness ratio
				43	calculating weight	29	calculate the ratio
				61	momentum equation	31	calculate temperature of mixture
				62	relating impulse and momentum conservation	69	calculate power used by the bulb
				68	kinetic energy formula	75	derive a formula to calculate the charge
				86	the work equation	76	calculate the number of electrons
				89	the power equation	99	calculate natural frequency and period
				96	calculating mechanical advantage	154	calculate gear ratio
				118	Hooke's law equation		
				141	projectile motion problems		
				143	calculating angular speed		
				144	finding the circumference of a circle		
				145	linear speed equation		
				153	equation for law of universal gravitation		
				179	the heat equation		
193	density formula						

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				208 pressure and temperature relationship 308 equation for Ohm's law 342 equation for Coulomb's law 438 calculating wave speeds 439 equation for the speed of a wave 525 equation for the speed of light	
II.I.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.	9 basic forms of energy 67 calculating potential energy 68 calculating kinetic energy 68 potential to kinetic energy conversions 69 kinetic energy and stopping distance of a car 70 potential to kinetic energy conversions 117 potential and kinetic energy in a spring 241 energy exists in many different forms 249 mechanical systems and energy	15 calculate potential energy of car 24 calculate kinetic energy of sled 47 calculate energy 47 identify forms of energy in an experimental system 48 investigate energy changes in chemical reactions

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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.	172 kinetic theory and temperature	33 investigate energy and phase changes 34 apply concept of energy and phase changes
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.	10 conservation of energy 67 potential energy explained 68 kinetic energy explained 70 law of conservation of energy 71 using energy conservation to solve problems 240 energy and systems 243 energy flow diagrams 249 energy flow diagram for mechanical systems 251 energy flow in natural systems	14 investigate exchange of energy in car and track system 15 apply law of energy conservation 42 model how atoms exchange energy 45 describe energy changes 46 investigate energy flow in a system 47 draw an energy flow diagram 57 draw energy flow diagram of the circuit

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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.	181 183 183 184	heat conduction heating systems and convection natural and forced convection thermal radiation	30	investigating heat transfer
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.	176 177 181	understanding the difference between heat and temperature heat and work thermal equilibrium	30	investigate difference between temperature and heat
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.	240 243 251	energy and systems energy flow diagrams energy flow in natural systems	44 45 46 47 57	friction and energy dissipation describe energy changes investigate energy flow in a system investigate friction as a part of energy flow draw energy flow diagram of the circuit

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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.	434 waves transmit energy 447 waves and energy 481 speed of light 486 photons 533 photon theory of light	
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.	436 longitudinal waves 436 transverse waves 437 frequency and amplitude and wavelength of waves 438 the speed of waves 456 speed of sound 461 wavelength of sound 468 pitch and the musical scale 523 electromagnetic spectrum 524 wavelength and frequency of visible light 526 low-energy electromagnetic waves 527 high-energy electromagnetic waves 536 the electromagnetic spectrum 537 infrared telescopes	99 explore transverse waves 100 study water waves 101 investigate standing waves and frequency 111 mixing primary colors of light 123 investigate visible light wavelengths 124 relating transverse waves on a spring to light waves

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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.	230 quantum theory explained 231 quantum model of the atom 478 seeing and reflected light 485 how the human eye sees color 486 photons 533 photon theory of light	42 relate idea that electrons exist at set energy levels to quantum theory 111 colors of light
II.1.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.	226 electrons and energy levels 229 absorption and emission of light by atomic electrons 230 the Bohr model and electron shells 230 quantum theory explained 230 explaining spectral lines 231 quantum model of the atom 534 atoms and photons 535 atoms absorb and emit light	42 relate idea that electrons exist at set energy levels to quantum theory 42 absorption and emission of light by electrons 43 spectral analysis and electron energy levels

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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.	9 energy in a system 9 stability of systems 114 systems in equilibrium 127 rotational equilibrium 128 equilibrium and architecture 423 restoring forces and equilibrium 423 equilibrium and harmonic motion	22 investigate equilibrium
II.I.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.	39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 221 electromagnetic and strong force 402 gravitational field	26 investigate projectile motion 40 find mass number of specific isotope

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II.I.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.	39 calculations pertaining to free fall 39 effect of gravity on motion 52 acceleration shown through strobe photography 88 work and gravity 137 projectile explained 138 free fall component of a trajectory 153 Newton's law of universal gravitation explained 154 understanding orbital motion 402 gravitational field	26 investigate projectile motion
II.I.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.	220 subatomic particles and charge 340 understanding electric charge 341 what causes shocks 341 charged objects and static electricity 354 understanding lightning 361 using magnetic forces	72 investigate the nature of electric charge

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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.	364 electromagnets 365 building an electromagnet 380 effect of current on a compass 382 using coils to concentrate a magnetic field 387 electromagnetic induction explained 388 Faraday's law of induction 522 electromagnetic waves	80 compare magnetic force and electric current in an electromagnet 80 explore properties of electromagnets 81 find relationship between current and magnetic field 82 investigate how a steel pin affects magnetic force created by a coil 85 investigate electromagnetic induction
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.	111 force vectors 112 resolving vectors 113 using a free-body diagram 115 finding resultant vector	23 draw a free body diagram 23 use force vectors

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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.	52 action-reaction pairs 59 Newton's third law 60 sorting out force pairs 63 law of conservation of momentum 64 using momentum conservation to solve problems 74 momentum and collisions 77 momentum and car safety 78 third law and rockets 117 Newton's third law and springs 128 the third law and physics of walls 158 Newton's third law and helicopters	12 investigate Newton's 3rd law of motion 13 apply the law of conservation of momentum 13 relate Newton's 3rd law of motion to car collisions

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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.	29	Newton's first law	8	investigate Newton's first law of motion
				35	quantitative understanding of second law	10	investigate Newton's second law of motion
				35	Newton's second law	12	investigate Newton's 3rd law of motion
				36	applying Newton's second law properly	13	relate Newton's 3rd law of motion to car collisions
				37	using second law formula		
				52	action-reaction pairs	23	Newton's second law of motion
				59	Newton's third law	25	apply Newton's second law of motion
				60	sorting out force pairs		
				78	third law and rockets	29	apply Newton's second law of motion
				117	Newton's third law and springs	95	Newton's 2nd law of motion and natural frequency
				128	the third law and physics of walls		
				158	Newton's third law and helicopters		
				424	Newton's second law and oscillators		
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.	17	comparing speeds	53	explore the concept of relativity
				17	nothing in the universe stays still	53	investigate frames of reference
				284	theory of special relativity	54	identify frame of reference
						55	a thought experiment on Einstein's theories

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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.	414	a pendulum's cycle	92	explore the meaning of amplitude
				414	understanding a cycle	92	explore the meaning of cycle
				416	period is the time for one cycle	92	explore harmonic motion using a pendulum
				416	frequency explained	93	measure the period of a pendulum
				417	frequency is the inverse of period	94	investigate harmonic motion with a pendulum
				418	amplitude explained	99	explore transverse waves
				430	identify period and frequency and cycle and amplitude	100	study water waves
				436	longitudinal waves	101	investigate standing waves and frequency
				436	transverse waves	123	measure wavelengths of visible light using a spectrometer
				437	frequency and amplitude and wavelength of waves	123	how colors of light relate to frequency and wavelength
				438	the speed of waves	124	relating transverse waves on a spring to light waves
				456	speed of sound		
				461	wavelength of sound		
				468	pitch and the musical scale		
				481	speed of light		
				483	color and light		
				524	energy and color of light		

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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.	442	reflected waves	106	investigate interference and beats
				442	refracted waves	111	colors of light
				443	diffraction explained	120	investigate reflection of light
				443	absorption explained	121	investigate refraction of light
				445	destructive interference	122	investigate diffraction of light
				445	constructive interference		
				469	frequency of sound and beats		
				478	seeing and reflected light		
				482	reflection of light		
				482	refraction of light		
				485	how the human eye sees color		
				501	reflection explained		
				503	understanding refraction		
				504	angles of incidence and refraction		
				528	diffraction and light		
				529	interference of light waves		
				530	diffraction gratings and spectrometers		

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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.	415	sound is a wave	98	study waves on a string
				435	waves and technology	104	properties of sound waves
				440	standing waves on a vibrating string	105	investigate sound wave interference
				446	how a laser works	111	mixing primary colors of light
				454	sound is a wave	111	research and explain how the eye works
				455	acoustics	111	colors of light
				458	how sound is recorded	113	use a mirror to observe reflected light
				459	sound is a wave	114	use a prism to investigate light rays
				461	how a French horn works	119	investigate lenses and magnification
				462	acoustics of concert halls	120	using a mirror to reflect light
				478	seeing and reflected light	121	use a lens to refract light
				484	how the human eye sees light	123	investigate visible light wavelengths
				485	how the human eye sees color		
				499	mirrors reflect light		
				505	fiber optics		
				523	electromagnetic spectrum		
				524	wavelength and frequency of visible light		
				526	low-energy electromagnetic waves		
				527	high-energy electromagnetic waves		
				536	the electromagnetic spectrum		

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				537 infrared telescopes	