

Correlation to Michigan Content Expectations: Essential - Physics (April 2007)

CPO Science Physics a First Course

Student Text and Investigation Manual

Standard #: Content Area	Standard	Content Statement	Performance expectation		Volume One Student Text Page	Volume Two Investigation Manual Page	
C1.01A	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Generate new questions that can be investigated in the laboratory or field.	4	what is an experiment	47	design an experiment
				8	designing experiments	94	design pendulum experiments
				8	scientific method		
				8	asking a scientific question		
				22	scientific method in action		
C1.01B	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables...	6	what is a variable	3	car launching technique is a possible source of error
				8	control and experimental variables	4	car launching technique is a possible source of error
				8	dependent variables	6	recognize and control variables
				8	independent variables	21	how close is your prediction to the actual measurement?
				16	graphs and dependent variables	26	spotting the landing point of the marble is tricky
				16	graphs and independent variables	27	identify and control variables
				24	importance of changing one variable at a time in an experiment	27	marble launching technique is a possible source of error
						52	find a percentage
		94	investigate variables and how they affect the period of a pendulum				

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C1.01C	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).	11	understand length measurement	1	collect accurate, precise data with electronic timer
				12	systems of measurement	1	mixed units for time
				13	time measurement units	6	design a better experiment
				14	basic unit of time	7	collect precise data
				29	measuring mass	8	make mass measurements
				171	how a thermometer works	10	make length measurement
				305	using a multimeter to measure current	12	record the times
				307	using a multimeter to measure resistance	13	design other experiments
						14	measure mass of car
						15	design another experiment
		17	measure string length				
		23	measure the mass				
		24	measure the time				
		27	how can photogate ensure consistent results?				
		28	measure height of track				
		33	measure mass of ice and cup				
		44	measure mass of car				
		44	make a precise time measurement				
		46	measure mass of car				

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				47 conduct the experiment you designed
				50 measure volume
				50 measure mass
				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
				76 measure mass of capacitor
				78 estimate the precision of measurements
				85 use a multimeter to measure voltage

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C1.01D	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Identify patterns in data and relate them to theoretical models.	4	what is analysis	4	construct a graph
				16	steps to follow for graph construction	11	find formula for acceleration
				16	constructing graphs	11	create a graph
				19	mathematical descriptions	13	derive a formula
				25	constructing a graph	15	graph speed vs. height
				26	interpreting distance/time graph	17	derive a formula to use with ropes and pulleys
				34	mathematical model of acceleration	17	calculate mechanical advantage
				35	Newton's second law equation	20	graph work done vs. deflection of rubber band
				41	average speed equation	21	graph speed vs. rubber band deflection
				43	calculating weight	25	graph friction vs. mass
				46	motion graphs	27	graph launch angle vs. range
				48	motion graphs	29	calculate the ratio
				56	analyze a speed/distance graph	29	find a mathematical name for the steepness ratio
				61	momentum equation	29	graph acceleration vs. steepness ratio
				62	relating impulse and momentum conservation	31	calculate temperature of mixture
				68	kinetic energy formula	45	make a graph of efficiency vs. speed
				86	the work equation		
89	the power equation						

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				96	calculating mechanical advantage	47	analyze the results
				112	using a graph to find force vector components	50	graph time vs. temperature
				118	Hooke's law equation	52	construct a graph
				141	projectile motion problems	69	calculate power used by the bulb
				143	calculating angular speed	71	find the average of the three times
				144	finding the circumference of a circle	75	derive a formula to calculate the charge
				145	linear speed equation	75	graph current vs. time for the capacitor
				153	equation for law of universal gravitation	76	calculate the number of electrons
				179	the heat equation	86	graph voltage vs. speed
				193	density formula	94	sketch harmonic motion graphs
				208	pressure and temperature relationship	99	calculate natural frequency and period
				308	equation for Ohm's law	154	calculate gear ratio
				342	equation for Coulomb's law	154	analyze gear ratio data
				419	harmonic motion graphs		
				420	finding the amplitude on a harmonic motion graph		
				438	calculating wave speeds		
				439	equation for the speed of a wave		

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				525	equation for the speed of light
C1.01E	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Describe a reason for a given conclusion using evidence from an investigation.		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 60 propose a relationship between power and voltage
C1.02A	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Critique whether or not specific questions can be answered through scientific investigations.	4 what is an experiment 8 designing experiments 8 asking a scientific question 8 scientific method 22 scientific method in action	6 do results agree with hypothesis? 47 design an experiment 94 design pendulum experiments

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C1.02B	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Identify and critique arguments about personal or societal issues based on scientific evidence.	53	relationship between science and technology
				72	energy usage and conservation
				78	rocket technology
				79	new technologies
				213	deep water submarine technology
				235	technology and archaeology
				273	how a smoke detector works
				458	recording sound
			532	applications of polarization	
C1.02C	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.	167	history of atomic theory
				218	atomic theory
				219	development of atom models

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C1.02D	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Evaluate scientific explanations in a peer review process or discussion format.	11	importance of units	each investigation contains a "thinking about what you observed" section, and students must be able to communicate and defend their findings from the investigation		
				11	communicating via measurement			
				26	applying your knowledge: three opportunities to research topics and write reports			
				132	explain your answer using diagrams		67	explain what happened
				132	applying your knowledge: two opportunities to research topics and write reports			
				163	applying your knowledge: two opportunities to research topics and write reports			
295	applying your knowledge: three opportunities to research topics and write reports							
C1.02E	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Evaluate the future career and occupational prospects of science fields.	53	science and photography			
				105	science and biomechanics			
				129	science and architecture			
				186	materials scientists			
				234	archaeologists			
				515	recording images			

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P2.01A Physics	Motion of Objects	Position — Time	Calculate the average speed of an object using the change of position and elapsed time.	17 speed of light 17 speed defined 18 speed units 18 calculating speed 45 skydiving and terminal speed 45 terminal speed 56 calculate speed from distance/time graph 143 angular speed	3 find the speed of the car 6 how can speed be measured? 7 measure the speed 9 why did the speed change? 10 find speed of car 21 measure speed of car 25 calculate speed of car 44 experiment and find average speed 46 measure speed of car
P2.01B Physics	Motion of Objects	Position — Time	Represent the velocities for linear and circular motion using motion diagrams (arrows on strobe pictures).	19 velocity defined 40 velocity defined 136 speed vs. velocity 136 working with velocity vector	
P2.01C Physics	Motion of Objects	Position — Time	Create line graphs using measured values of position and elapsed time.	46 position vs. time graphs 47 position vs. time graph for accelerating motion	4 position vs. time graph
P2.01D Physics	Motion of Objects	Position — Time	Describe and analyze the motion that a position-time graph represents, given the graph.	46 position vs. time graphs 47 position vs. time graph for accelerating motion	4 position vs. time graph

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P2.01E Physics	Motion of Objects	Position — Time	Describe and classify various motions in a plane as one dimensional, two dimensional, circular, or periodic.	39	calculations pertaining to free fall	26	investigate projectile motion
				39	effect of gravity on motion	92	explore the meaning of amplitude
				52	acceleration shown through strobe photography	92	explore the meaning of cycle
				88	work and gravity	92	explore harmonic motion using a pendulum
				112	resolving vectors	93	measure the period of a pendulum
				137	projectile explained	94	investigate harmonic motion with a pendulum
				138	free fall component of a trajectory		
				402	gravitational field		
				414	a pendulum's cycle		
				414	understanding a cycle		
				416	frequency explained		
				416	period is the time for one cycle		
				417	frequency is the inverse of period		
				418	amplitude explained		
				430	identify period and frequency and cycle and amplitude		

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P2.01F Physics	Motion of Objects	Position — Time	Distinguish between rotation and revolution and describe and contrast the two speeds of an object like the Earth.	17	speed defined	6 how can speed be measured? 26 investigate projectile motion
				17	speed of light	
				18	calculating speed	
				39	calculations pertaining to free fall	
				39	effect of gravity on motion	
				45	skydiving and terminal speed	
				45	terminal speed	
				52	acceleration shown through strobe photography	
				88	work and gravity	
				137	projectile explained	
				138	free fall component of a trajectory	
				142	angular speed vs. linear speed	
				143	angular speed	
				153	Newton's law of universal gravitation explained	
154	understanding orbital motion					
402	gravitational field					

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page	
P2.02A Physics	Motion of Objects	Velocity — Time	Distinguish between the variables of distance, displacement, speed, velocity, and acceleration.	17	constant speed	6 how can speed be measured? 11 investigating net force and acceleration
				17	speed of light	
				17	speed defined	
				18	calculating speed	
				19	velocity defined	
				32	acceleration defined	
				33	acceleration and velocity	
				40	velocity defined	
				45	skydiving and terminal speed	
				45	terminal speed	
				134	understanding displacement	
136	speed vs. velocity					
143	angular speed					
P2.02B Physics	Motion of Objects	Velocity — Time	Use the change of speed and elapsed time to calculate the average acceleration for linear motion.	32	acceleration of sports cars	11 compare and contrast speed and acceleration 11 find acceleration of car 25 calculate acceleration of car 28 calculate acceleration 28 investigate acceleration on a ramp
				33	calculating acceleration	
				40	acceleration of falling objects	
				149	acceleration and circular motion	

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P2.02C Physics	Motion of Objects	Velocity — Time	Describe and analyze the motion that a velocity-time graph represents, given the graph.	48	speed vs. time graph
				49	speed vs. time graph for accelerating motion
				51	finding distance from a speed vs. time graph
P2.02D Physics	Motion of Objects	Velocity — Time	State that uniform circular motion involves acceleration without a change in speed.	17	constant speed
				147	centripetal force
				148	centripetal force
P3.01A Physics	Forces and Motion	Basic Forces in Nature	Identify the force(s) acting between objects in “direct contact” or at a distance.	28	force defined
				52	action-reaction pairs
				59	Newton’s third law
				60	sorting out force pairs
				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				
				11	speed vs. time graph
				11	investigating net force and acceleration
				12	investigate Newton's 3rd law of motion
				13	relate Newton's 3rd law of motion to car collisions

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P3.02A Physics	Forces and Motion	Net Forces	Identify the magnitude and direction of everyday forces (e.g., wind, tension in ropes, pushes and pulls, weight).	29 mass and inertia 31 net force explained 37 net force and second law calculating 39 calculations pertaining to free fall 39 effect of gravity on motion 43 weight vs. mass 43 calculating weight from mass 44 weight vs. mass 45 effects of air resistance 52 acceleration shown through strobe photography 88 work and gravity 94 friction and machines 101 friction explained 116 when net force is zero 119 cause of friction 119 friction explained 120 static and sliding friction 122 reducing friction 123 useful friction	9 research and define inertia and weight and mass 11 investigate net force 22 when net force is zero 24 investigate effect of friction 26 investigate projectile motion

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				137 projectile explained 138 free fall component of a trajectory 402 gravitational field 418 friction and damping	
P3.02B Physics	Forces and Motion	Net Forces	Compare work done in different situations.	66 energy is stored work 86 calculating work 88 calculating work	19 investigate concept of energy as stored work
P3.02C Physics	Forces and Motion	Net Forces	Calculate the net force acting on an object.	31 net force explained 37 net force and second law calculating 116 when net force is zero	11 investigate net force 22 when net force is zero
P3.03A Physics	Forces and Motion	Newton's Third Law	Identify the action and reaction force from examples of forces in everyday situations (e.g., book on a table, walking across the floor, pushing open a door).	52 action-reaction pairs 59 Newton's third law 60 sorting out force pairs 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 relate Newton's 3rd law of motion to car collisions

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P3.04A Physics	Forces and Motion	Forces and Acceleration	Predict the change in motion of an object acted on by several forces.	28 force defined 35 quantitative understanding of second law 36 balanced and unbalanced forces 36 applying Newton's second law properly 37 using second law formula	25 apply Newton's second law of motion 29 apply Newton's second law of motion
P3.04B Physics	Forces and Motion	Forces and Acceleration	Identify forces acting on objects moving with constant velocity (e.g., cars on a highway).	19 velocity defined 28 force defined 40 velocity defined 136 speed vs. velocity	
P3.04C Physics	Forces and Motion	Forces and Acceleration	Solve problems involving force, mass, and acceleration in linear motion (Newton's second law).	35 quantitative understanding of second law 36 applying Newton's second law properly 37 using second law formula	25 apply Newton's second law of motion 29 apply Newton's second law of motion

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P3.04D Physics	Forces and Motion	Forces and Acceleration	Identify the force(s) acting on objects moving with uniform circular motion (e.g., a car on a circular track, satellites in orbit).	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 142 angular speed vs. linear speed 154 understanding orbital motion 402 gravitational field	26 investigate projectile motion
P3.06A Physics	Forces and Motion	Gravitational Interactions	Explain earth-moon interactions (orbital motion) in terms of forces.	153 Newton's law of universal gravitation explained 154 understanding orbital motion	
P3.06B Physics	Forces and Motion	Gravitational Interactions	Predict how the gravitational force between objects changes when the distance between them changes.	153 Newton's law of universal gravitation explained	

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P3.06C Physics	Forces and Motion	Gravitational Interactions	Explain how your weight on Earth could be different from your weight on another planet.	29 mass and inertia 30 units of force 43 calculating weight from mass 43 weight vs. mass 44 weight vs. mass	9 research and define inertia and weight and mass
P3.07A Physics	Forces and Motion	Electric Charges	Predict how the electric force between charged objects varies when the distance between them and/or the magnitude of charges change.	342 electric forces are very strong 404 the electric field	89 understand and investigate electric and gravitational fields
P3.07B Physics	Forces and Motion	Electric Charges	Explain why acquiring a large excess static charge (e.g., pulling off a wool cap, touching a Van de Graaff generator, combing) affects your hair.	340 understanding electric charge 341 what causes shocks 341 charged objects and static electricity 354 understanding lightning	72 investigate the nature of electric charge

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P4.01A Physics	Forms of Energy and Energy Transformations	Energy Transfer	Account for and represent energy into and out of systems using energy transfer diagrams.	9	basic forms of energy	14	investigate exchange of energy in car and track system
				10	conservation of energy	15	apply law of energy conservation
				67	potential energy explained	42	model how atoms exchange energy
				68	kinetic energy explained	45	describe energy changes
				70	law of conservation of energy	46	investigate energy flow in a system
				71	using energy conservation to solve problems	47	identify forms of energy in an experimental system
				240	energy and systems	47	draw an energy flow diagram
				241	energy exists in many different forms	57	draw energy flow diagram of the circuit
				243	energy flow diagrams		
				249	energy flow diagram for mechanical systems		
P4.01B Physics	Forms of Energy and Energy Transformations	Energy Transfer	Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball).	177	heat and work	104	properties of sound waves
				415	sound is a wave	105	investigate sound wave interference
				454	sound is a wave		
				458	how sound is recorded		
				459	sound is a wave		

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P4.02A Physics	Forms of Energy and Energy Transformations	Energy Transformation	Account for and represent energy transfer and transformation in complex processes (interactions).	67	potential energy explained	14	investigate exchange of energy in car and track system
				68	potential to kinetic energy conversions	15	apply law of energy conservation
				68	kinetic energy explained	44	friction and energy dissipation
				70	potential to kinetic energy conversions	45	describe energy changes
				70	law of conservation of energy	46	investigate energy flow in a system
				71	using energy conservation to solve problems	47	investigate friction as a part of energy flow
				117	potential and kinetic energy in a spring	48	investigate energy changes in chemical reactions
				240	energy and systems	57	draw energy flow diagram of the circuit
				243	energy flow diagrams		
				249	mechanical systems and energy		
				249	energy flow diagram for mechanical systems		
				251	energy flow in natural systems		

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P4.02B Physics	Forms of Energy and Energy Transformations	Energy Transformation	Name devices that transform specific types of energy into other types (e.g., a device that transforms electricity into motion).	333	transformers	80	compare magnetic force and electric current in an electromagnet
				385	how an electric motor works	80	explore properties of electromagnets
				386	how a battery-powered electric motor works	81	find relationship between current and magnetic field
				389	how a generator works	83	build a simple electric motor
				390	how transformers work	84	build an electric motor and perform experiments
					87	investigate how generators work	
P4.02C Physics	Forms of Energy and Energy Transformations	Energy Transformation	Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision).	10	conservation of energy	42	model how atoms exchange energy
						47	draw an energy flow diagram
P4.02D Physics	Forms of Energy and Energy Transformations	Energy Transformation	Explain why all the stored energy in gasoline does not transform to mechanical energy of a vehicle.	94	work and simple machines	18	compare and contrast input and output work
				101	output work is always less than input work	44	friction and energy dissipation
						47	investigate friction as a part of energy flow

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P4.03A Physics	Forms of Energy and Energy Transformations	Kinetic and Potential Energy	Identify the form of energy in given situations (e.g., moving objects, stretched springs, rocks on cliffs, energy in food).	9 240 241 243 251	basic forms of energy energy and systems energy exists in many different forms energy flow diagrams energy flow in natural systems	45 describe energy changes 46 investigate energy flow in a system 47 identify forms of energy in an experimental system 57 draw energy flow diagram of the circuit
P4.03B Physics	Forms of Energy and Energy Transformations	Kinetic and Potential Energy	Describe the transformation between potential and kinetic energy in simple mechanical systems (e.g., pendulums, roller coasters, ski lifts).	67 68 68 69 70 117 249	calculating potential energy calculating kinetic energy potential to kinetic energy conversions kinetic energy and stopping distance of a car potential to kinetic energy conversions potential and kinetic energy in a spring mechanical systems and energy	15 calculate potential energy of car 24 calculate kinetic energy of sled 47 calculate energy
P4.03C Physics	Forms of Energy and Energy Transformations	Kinetic and Potential Energy	Explain why all mechanical systems require an external energy source to maintain their motion.	94 101	work and simple machines output work is always less than input work	18 compare and contrast input and output work

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P4.04A Physics	Forms of Energy and Energy Transformations	Wave Characteristics	Describe specific mechanical waves (e.g., on a demonstration spring, on the ocean) in terms of wavelength, amplitude, frequency, and speed.	436 longitudinal waves 436 transverse waves 437 frequency and amplitude and wavelength of waves 438 the speed of waves 440 standing waves on a vibrating string 461 wavelength of sound	98 study waves on a string 99 explore transverse waves 100 study water waves 101 investigate standing waves and frequency 124 relating transverse waves on a spring to light waves
P4.04B Physics	Forms of Energy and Energy Transformations	Wave Characteristics	Identify everyday examples of transverse and compression (longitudinal) waves.	435 how to recognize waves 436 longitudinal waves 436 transverse waves 440 standing waves on a vibrating string 459 sound waves and different media	98 study waves on a string 99 explore transverse waves 100 study water waves 124 relating transverse waves on a spring to light waves
P4.04C Physics	Forms of Energy and Energy Transformations	Wave Characteristics	Compare and contrast transverse and compression (longitudinal) waves in terms of wavelength, amplitude, and frequency.	436 longitudinal waves 436 transverse waves 437 frequency and amplitude and wavelength of waves 438 the speed of waves 461 wavelength of sound	99 explore transverse waves 100 study water waves 101 investigate standing waves and frequency 124 relating transverse waves on a spring to light waves
P4.05A Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Identify everyday examples of energy transfer by waves and their sources.	434 waves transmit energy 435 waves and technology 447 waves and energy	

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P4.05B Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Explain why an object (e.g., fishing bobber) does not move forward as a wave passes under it.	434 waves transmit energy 447 waves and energy	
P4.05C Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Provide evidence to support the claim that sound is energy transferred by a wave, not energy transferred by particles.	415 sound is a wave 454 sound is a wave 458 how sound is recorded 459 sound is a wave 467 how the ear works	104 properties of sound waves 105 investigate sound wave interference
P4.05D Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Explain how waves propagate from vibrating sources and why the intensity decreases with the square of the distance from a point source.	434 waves transmit energy 447 waves and energy 457 understanding the Doppler effect 478 seeing and reflected light 480 light intensity and the inverse square law 481 speed of light 485 how the human eye sees color	111 colors of light

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P4.05E Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Explain why everyone in a classroom can hear one person speaking, but why an amplification system is often used in the rear of a large concert auditorium.	455 acoustics 456 speed of sound 461 how a French horn works 462 acoustics of concert halls 468 pitch and the musical scale	
P4.06A Physics	Forms of Energy and Energy Transformations	Electromagnetic Waves	Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy.	523 electromagnetic spectrum 524 wavelength and frequency of visible light 536 the electromagnetic spectrum	111 mixing primary colors of light 123 investigate visible light wavelengths
P4.06B Physics	Forms of Energy and Energy Transformations	Electromagnetic Waves	Explain why radio waves can travel through space, but sound waves cannot.	435 waves and technology 523 electromagnetic spectrum 524 wavelength and frequency of visible light 536 the electromagnetic spectrum	111 mixing primary colors of light 123 investigate visible light wavelengths
P4.06C Physics	Forms of Energy and Energy Transformations	Electromagnetic Waves	Explain why there is a delay between the time we send a radio message to astronauts on the moon and when they receive it.	435 waves and technology	

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P4.06D Physics	Forms of Energy and Energy Transformations	Electromagnetic Waves	Explain why we see a distant event before we hear it (e.g., lightning before thunder, exploding fireworks before the boom).	437 frequency and amplitude and wavelength of waves 438 the speed of waves 461 wavelength of sound 481 speed of light	101 investigate standing waves and frequency
P4.08A Physics	Forms of Energy and Energy Transformations	Wave Behavior — Reflection and Refraction	Draw ray diagrams to indicate how light reflects off objects or refracts into transparent media.	482 reflection of light 499 mirrors reflect light 501 reflection explained 502 the law of reflection 502 drawing a ray diagram 508 ray diagram of an image in a mirror 510 ray diagram for a converging lens 511 the image formed by a lens	113 investigate law of reflection 113 use a mirror to observe reflected light 113 construct ray diagrams 114 use results to derive law of reflection 114 use a prism to investigate light rays 114 construct ray diagrams 115 investigate refraction 119 investigate lenses and magnification 120 using a mirror to reflect light 120 investigate reflection of light 121 use a lens to refract light

Correlation to Michigan Content Expectations: Essential - Physics (April 2007)

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page
P4.08B Physics	Forms of Energy and Energy Transformations	Wave Behavior — Reflection and Refraction	Predict the path of reflected light from flat, curved, or rough surfaces (e.g., flat and curved mirrors, painted walls, paper).	482 reflection of light 498 optical systems 499 converging and diverging lenses 499 mirrors reflect light 501 reflection explained 502 the law of reflection 514 understanding optical systems	113 investigate law of reflection 113 use a mirror to observe reflected light 114 use results to derive law of reflection 120 using a mirror to reflect light 120 investigate reflection of light
P4.09A Physics	Forms of Energy and Energy Transformations	Nature of Light	Identify the principle involved when you see a transparent object (e.g., straw, piece of glass) in a clear liquid.	482 refraction of light 503 understanding refraction 504 angles of incidence and refraction	115 investigate refraction 121 investigate refraction of light
P4.09B Physics	Forms of Energy and Energy Transformations	Nature of Light	Explain how various materials reflect, absorb, or transmit light in different ways.	482 reflection of light 501 reflection explained	120 investigate reflection of light
P4.09C Physics	Forms of Energy and Energy Transformations	Nature of Light	Explain why the image of the Sun appears reddish at sunrise and sunset.	483 white light is a mixture of colors 483 color and light 503 index of refraction 524 energy and color of light	122 observe white light through diffraction glasses 123 measure wavelengths of visible light using a spectrometer 123 how colors of light relate to frequency and wavelength

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page
P4.10A Physics	Forms of Energy and Energy Transformations	Current Electricity — Circuits	Describe the energy transformations when electrical energy is produced and transferred to homes and businesses.	255	energy in the ocean
				330	alternating current
				330	direct current
				333	transformers
				389	how a generator works
				390	how transformers work
				80	compare magnetic force and electric current in an electromagnet
				80	explore properties of electromagnets
				81	find relationship between current and magnetic field
				87	investigate how generators work
				157	research electricity generation methods

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page		
P4.10B Physics	Forms of Energy and Energy Transformations	Current Electricity — Circuits	Identify common household devices that transform electrical energy to other forms of energy, and describe the type of energy transformation.	300	resistors	61	investigate resistance
				306	understanding electrical resistance	63	investigate resistance and potentiometers
				307	measuring resistance	69	finding power used by a circuit
				309	resistance of common objects	70	explain what you observed in terms of energy and power
				311	resistors	71	calculate energy and power
				319	resistance in a series circuit		
				328	calculating power in a circuit		
				332	electrical safety and ground fault interrupt outlets		
				332	electrical safety and circuit breakers		
				353	capacitor safety		

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page		
P4.10C Physics	Forms of Energy and Energy Transformations	Current Electricity — Circuits	Given diagrams of many different possible connections of electric circuit elements, identify complete circuits, open circuits, and short circuits and explain the reasons for the classification.	299	examples of electric circuits in nature	57	open and closed circuits
				299	electric circuits	57	build circuits
				300	circuit diagrams	59	draw and interpret circuit diagrams
				301	open and closed circuits	60	a circuit with a dimmer switch
				301	battery circuits	65	investigate series circuits
				318	series circuits	65	build a circuit with three bulbs and a switch
				323	parallel circuits	66	investigate series circuits
				326	parallel circuits in homes	68	investigate parallel circuits
				69	construct a simple circuit		

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Student Text and Investigation Manual

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page		
P4.10D Physics	Forms of Energy and Energy Transformations	Current Electricity — Circuits	Discriminate between voltage, resistance, and current as they apply to an electric circuit.	298	electric current	58	measure voltage
				300	resistors	59	measure current
				302	current in simple circuits	60	measure voltage
				303	understanding voltage	61	investigate resistance
				305	measuring current with a multimeter	62	investigate Ohm's law
				306	understanding electrical resistance	63	investigate resistance and potentiometers
				307	measuring resistance	63	use Ohm's law
				308	Ohm's law	65	measure the voltage
				309	resistance of common objects	66	current in a series circuit
				311	resistors	67	Ohm's law and short circuits
				319	resistance in a series circuit	74	investigate the flow of electric charge
				319	current in a series circuit	75	work with Ohm's law
				320	voltage in a series circuit		
				321	Ohm's law and voltage drops		
				323	current in a parallel circuit		
				324	voltage in a parallel circuit		
				346	charge and current		
				349	voltage and charge		
				351	voltage and capacitors		

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Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume One Student Text Page	Volume Two Investigation Manual Page
P4.12A Physics	Forms of Energy and Energy Transformations	Nuclear Reactions	Describe peaceful technological applications of nuclear fission and radioactive decay.	273 the process of carbon dating	
P4.12B Physics	Forms of Energy and Energy Transformations	Nuclear Reactions	Describe possible problems caused by exposure to prolonged radioactive decay.	267 nuclear reactions explained 268 nuclear reactions and energy 271 types of radioactivity 272 half-life	51 investigate concepts of radioactivity 52 investigate concept of half-life
P4.12C Physics	Forms of Energy and Energy Transformations	Nuclear Reactions	Explain how stars, including our Sun, produce huge amounts of energy (e.g., visible, infrared, ultraviolet light).	269 fusion reactions 270 fission reactions	