

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C1.01A Chemistry	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Generate new questions that can be investigated in the laboratory or field.	7	experimentation begins with a question	6	how do we ask questions and get answers from nature?
				10	the research question and hypothesis	7	design your own experiment
				19	design your own experiment	7	variables in an experiment
				42	devise an experiment	7	perform your own experiment
					9	design three experiments using car and ramp	
					10	conduct car/ramp experiment	
					16	decide how to vary the force on the car for this experiment	
					16	investigate Newton's 2nd law	
					26	what variables can be changed?	
					34	investigate motion on a rollercoaster	
					75	design pendulum experiment	
					75	perform self-designed experiment	
					93	decision trees and the advantage of doing multiple trials	

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					<p>151 design experiment to find out if mass is conserved</p> <p>166 what three factors influence dissolving rate?</p>

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C1.01B Chemistry	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...	11	control and experimental variables	7	doing a controlled experiment
				11	controlling variables in experiments	7	what variables should be controlled?
				19	which group did the best experiment?	11	calculate % error
				19	did you run a controlled experiment?	18	evaluate graphs as to whether or not they show relationships between variables
				20	what factors could explain the variability in their data?	21	evaluate percent change for data collected
				26	independent and dependent variables	21	choose independent and dependent variables for graph
						21	think about percent change
						27	recognize variables
						75	evaluate statistical significance
						76	calculate % error
		129	control the height of the liquid	165	what does the word "control" mean?		
		165	why was plain water tested?	167	evaluate method based on data		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C1.01C Chemistry	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).	3 5 6 12 78 280 280 288	time measurement make measurements with precision scientists use metric units importance of reliable and accurate data collection use and understand mass measurements measuring volume of solids measuring volume of liquids find the thickness of a single card	4 4 5 6 6 7 7 7 7 9 9 9 9 10 12 12 17 17 17 24	difference between precise and accurate data making measurements with precision electronic timer and release technique record time interval use a ruler to make a measurement measure and record variables conduct three experiments with appropriate equipment collect speed data design three experiments and choose equipment selecting ramp and photogates select equipment and set up experiment make metric length measurement measure the force measure the force record times collect weight data

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					25 measure and record the force
					30 rigging block and tackle
					30 measure height difference
					36 make precise height measurements
					36 collect precise speed and height data
					44 using electrical meter
					46 using electrical meter
					48 using electrical meter
					50 using electrical meter
					63 making measurements with precision
					75 make precise length measurements
					75 collect mass and amplitude data
					116 measuring mass
					117 measuring volume
					145 carry out procedure and select equipment
					145 plan a procedure and select necessary equipment
					151 plan procedures and select materials

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					151 select materials from list 158 use a thermometer 167 collect time data and record observations 176 measure pH

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C1.01D Chemistry	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Identify patterns in data and relate them to theoretical models.	24	making a graph	6	compare results with other groups
				24	interpretations of patterns in data	11	analyze speed change of car
				26	creating graphs	11	graph speed vs. position
				27	reading a graph	13	graph distance vs. time
				41	make a graph	15	interpret a speed vs. time graph
				42	interpreting distance/time graph	15	construct a quantitative graphical model
				42	analyze a speed/distance graph	18	study data table for relationship between force and motion
				78	analyze lever diagram	25	analyze block and tackle data
						25	create a mathematical model
						27	find math rule for lever equilibrium
						27	analyze lever equilibrium data
						28	derive a math formula
						35	does data support hypothesis?
		37	organize data into a graph of speed vs. height				
		45	did battery voltage change?				

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					51 graph voltage vs. current 76 analyze pendulum data 121 graph mass vs. volume 129 find average velocity 147 students analyze chemical change lab results 147 organize observations into a category table 167 average dissolving rate 181 construct a graphical model 183 construct a temperature vs. time graph

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
C1.01E Chemistry	Inquiry, Reflection, and Social Implications	Scientific Inquiry	Describe a reason for a given conclusion using evidence from an investigation.	19 which group did the best experiment?	18 evaluate graphs as to whether or not they show relationships between variables 21 evaluate percent change for data collected 21 construct reasonable explanation based on data 35 study data and determine importance of height on speed of marble 45 analyze data and explain a rule 75 evaluate statistical significance 157 add new rules to list based on findings 167 evaluate method based on data

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C1.02A Chemistry	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Critique whether or not specific questions can be answered through scientific investigations.	7	experimentation begins with a question	6	how do we ask questions and get answers from nature?
				10	the research question and hypothesis	6	predict which car will move fastest
				19	design your own experiment	7	design your own experiment
				20	finding variability in data	7	test the effect of one other variable
				42	devise an experiment	7	variables in an experiment
				79	look at force data and decide the usefulness of a machine	9	design three experiments using car and ramp
				16	decide how to vary the force on the car for this experiment	18	use data to describe relationship between force and motion
				19	use data to infer correct relationship between variables	26	what variables can be changed?
				27	think about the variables	30	interpret block and tackle data
				34	where does the marble move the fastest?		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					<p>43 how did A and B tapes acquire different charge?</p> <p>75 investigate variables that affect the period of a pendulum</p> <p>75 design pendulum experiment</p> <p>93 decision trees and the advantage of doing multiple trials</p> <p>141 build models of Na and Cl and use them to explain bonding</p> <p>151 explain how hypothesis compares to results</p> <p>151 design experiment to find out if mass is conserved</p> <p>151 perform the experiment you designed</p> <p>166 what three factors influence dissolving rate?</p>
C1.02B Chemistry	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Identify and critique arguments about personal or societal issues based on scientific evidence.	<p>214 ultrasound technology</p> <p>220 voice recognition technology</p> <p>294 invention of Kevlar</p> <p>400 clean air act of 1970</p>	163 evaluating choice of favorite car

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
C1.02C Chemistry	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.	73 impact of Da Vinci's work 110 research Franklin's electricity experiments 313 development of atomic theory 324 research and create a poster to illustrate development of atomic model 400 research the Clean Air Act of 1970 and 1990 434 research local water supply history 464 research the history of heat and temperature	130 investigate Rutherford's gold foil experiment

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
C1.02D Chemistry	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Evaluate scientific explanations in a peer review process or discussion format.	20 explain your reasoning	9 present conclusions to the class 15 discuss and test ideas with your group 19 explain how you arrived at your answer 29 discuss what you learned about gears 37 describe the flow of energy based on experimental graph 39 give a brief presentation to the class 47 discuss an explanation with your group 47 present and defend an explanation 129 explain your answer and justify 145 present findings and methods used 151 present results to the class
C1.02E Chemistry	Inquiry, Reflection, and Social Implications	Scientific Reflection and Social Implications	Evaluate the future career and occupational prospects of science fields.		174 water quality testing 177 chemistry and photography

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
C2.02A Chemistry	Forms of Energy	Molecules in Motion	Describe conduction in terms of molecules bumping into each other to transfer energy. Explain why there is better conduction in solids and liquids than gases.	468 heat transfer through air 468 densely packed solids are good conductors of heat 470 convection currents and weather 470 warming hands over candle 472 convection currents in water 476 solid road surface emits radiation 478 apply knowledge of heat transfer to different situations 481 global warming and heat transfer by radiation	190 investigate conduction through all states of matter 192 investigate convection in liquids 194 investigate radiation emitted by solids 194 investigate radiation emitted by liquids
C2.02B Chemistry	Forms of Energy	Molecules in Motion	Describe the various states of matter in terms of the motion and arrangement of the molecules (atoms) making up the substance.	285 characteristics of matter related to its state	118 observe melting process and study quantitatively 118 think of melting process at molecular level
C3.03A Chemistry	Energy Transfer and Conservation	Heating Impacts	Describe how heat is conducted in a solid.	469 thermal conductivity explained	190 investigate and rank materials for thermal conductivity
C3.03B Chemistry	Energy Transfer and Conservation	Heating Impacts	Describe melting on a molecular level.	284 changes of state 451 increasing temperature means increasing motion of molecules	119 adding heat energy to melt an ice cube 119 energy and phase changes

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
C3.04A Chemistry	Energy Transfer and Conservation	Endothermic and Exothermic Reactions	Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory.	381	exothermic reactions and MREs	158	investigate energy changes in chemical reactions
				382	endothermic reactions and cold packs	158	measure energy changes in 3 different reactions
C3.04B Chemistry	Energy Transfer and Conservation	Endothermic and Exothermic Reactions	Explain why chemical reactions will either release or absorb energy.			158	measure energy changes in 3 different reactions
C4.02A Chemistry	Properties of Matter	Nomenclature	Name simple binary compounds using their formulae.	339	naming compounds	143	name chemical compounds
C4.02B Chemistry	Properties of Matter	Nomenclature	Given the name, write the formula of simple binary compounds.	336	writing a chemical formula	143	predict chemical formulas
				338	summary of chemical formula writing rules	145	determine empirical formula
C4.03A Chemistry	Properties of Matter	Properties of Substances	Recognize that substances that are solid at room temperature have stronger attractive forces than liquids at room temperature, which have stronger attractive forces than gases at room temperature.	284	states of matter and arrangement of molecules	118	molecules in a liquid
						118	investigate melting

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
C4.03B Chemistry	Properties of Matter	Properties of Substances	Recognize that solids have a more ordered, regular arrangement of their particles than liquids and that liquids are more ordered than gases.	284 states of matter and arrangement of molecules	118 molecules in a liquid 118 investigate melting
C4.08A Chemistry	Properties of Matter	Atomic Structure	Identify the location, relative mass, and charge for electrons, protons, and neutrons.	311 location/size/charge of subatomic particles 311 protons/neutrons/electrons 318 proton/electron attraction	132 building atom models 133 location of electrons in atom 133 protons and neutrons 136 model stable and neutral atoms 137 build atomic models 140 review subatomic particles
C4.08B Chemistry	Properties of Matter	Atomic Structure	Describe the atom as mostly empty space with an extremely small, dense nucleus consisting of the protons and neutrons and an electron cloud surrounding the nucleus.	388 showing valence electrons in a diagram	140 find the number of electrons in outermost level
C4.08C Chemistry	Properties of Matter	Atomic Structure	Recognize that protons repel each other and that a strong force needs to be present to keep the nucleus intact.	389 electromagnetic force 389 strong nuclear force 389 forces in the nucleus	136 strong force

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C4.08D Chemistry	Properties of Matter	Atomic Structure	Give the number of electrons and protons present if the fluoride ion has a -1 charge.	315	atomic number discussed	133	exploring isotopes
				316	isotopes explained	133	identify mass number
				316	mass number discussed	133	identify atomic number
				322	atomic mass on the periodic table	133	identify element symbol and name
				322	mass number on the periodic table	136	understanding isotopes
				322	atomic number on the periodic table	136	mass number
				322	atomic number on the periodic table	136	atomic number
C4.09A Chemistry	Properties of Matter	Periodic Table	Identify elements with similar chemical and physical properties using the periodic table.	322	chemical symbols and element names	136	ions
				141	when an atom ionizes	141	when an atom ionizes
				320	groups of elements	133	using the periodic table
				321	groups of elements and valence shells	141	build model of Na and Cl atoms and explain why they bond to form a molecule
				329	periodic table columns and valence electrons	142	arrangement of electrons and groups of elements
				330	bonding and periodic table position		
332	periodic table and electronegativities						
335	periodic table and oxidation numbers						

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
C4.10A Chemistry	Properties of Matter	Neutral Atoms, Ions, and Isotopes	List the number of protons, neutrons, and electrons for any given ion or isotope.	315	atomic number discussed	133	exploring isotopes
				316	isotopes explained	133	identify mass number
				316	mass number discussed	133	identify atomic number
				322	atomic mass on the periodic table	133	identify element symbol and name
				322	mass number on the periodic table	136	understanding isotopes
				322	atomic number on the periodic table	136	mass number
				322	chemical symbols and element names	136	atomic number
C5.02A Chemistry	Changes in Matter	Chemical Changes	Balance simple chemical equations applying the conservation of matter.	371	which of the equations is balanced?	149	balance these equations
C5.02B Chemistry	Changes in Matter	Chemical Changes	Distinguish between chemical and physical changes in terms of the properties of the reactants and products.	353	physical and chemical changes and digestion	146	investigate and observe chemical and physical changes in the lab
				355	physical and chemical changes in tire recycling	148	reactants and products
				359	balancing chemical equations	149	practice balancing equations
				372	determine if changes are chemical or physical	152	write the balanced equation
						152	predict how much product formed given the reactants

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
C5.02C Chemistry	Changes in Matter	Chemical Changes	Draw pictures to distinguish the relationships between atoms in physical and chemical changes.	284 states of matter and arrangement of molecules 357 chemical reactions involve rearrangement of atoms 451 increasing temperature means increasing motion of molecules	118 molecules in a liquid 118 investigate melting 119 adding heat energy to melt an ice cube 157 predict the products of double displacement reactions
C5.04A Chemistry	Changes in Matter	Phase Change/Diagrams	Compare the energy required to raise the temperature of one gram of aluminum and one gram of water the same number of degrees.	457 specific heat and the heat equation 458 specific heat 459 specific heat of different substances	119 investigate temperature and energy transfer in melting process
C5.04B Chemistry	Changes in Matter	Phase Change/Diagrams	Measure, plot, and interpret the graph of the temperature versus time of an ice-water mixture, under slow heating, through melting and boiling.		119 investigate melting and create a graph 119 create a temperature vs. time graph of phase change
C5.05A Chemistry	Changes in Matter	Chemical Bonds — Trends	Predict if the bonding between two atoms of different elements will be primarily ionic or covalent.	324 use the periodic table to predict chemical formulas 324 which element is more likely to combine with other elements? 330 Lewis Dot diagrams 335 chemical bonding and the periodic table	141 modeling a chemical bond 143 ionic compounds

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page		Volume 2 Investigation Manual page	
C5.05B Chemistry	Changes in Matter	Chemical Bonds — Trends	Predict the formula for binary compounds of main group elements.	336	writing a chemical formula	143	predict chemical formulas
				338	summary of chemical formula writing rules	145	determine empirical formula
C5.07A Chemistry	Changes in Matter	Acids and Bases	Recognize formulas for common inorganic acids, carboxylic acids, and bases formed from families I and II.			176	investigate acids and bases
C5.07B Chemistry	Changes in Matter	Acids and Bases	Predict products of an acid-base neutralization.	437	concentration of ions and pH	176	measure pH of everyday solutions
				440	examples of acid and base chemistry	176	investigate acids and bases
				443	pH and blood		
C5.07C Chemistry	Changes in Matter	Acids and Bases	Describe tests that can be used to distinguish an acid from a base.	437	concentration of ions and pH	176	measure pH of everyday solutions
				440	examples of acid and base chemistry	176	measure pH
				443	pH and blood	176	investigate acids and bases
C5.07D Chemistry	Changes in Matter	Acids and Bases	Classify various solutions as acidic or basic, given their pH.	437	concentration of ions and pH	176	measure pH of everyday solutions
				440	examples of acid and base chemistry	176	measure pH
				443	pH and blood		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
C5.07E Chemistry	Changes in Matter	Acids and Bases	Explain why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds.	444 448	acid rain explained research the issue of acid rain	178	investigate effect of acid rain on microorganisms
C5.08A Chemistry	Changes in Matter	Carbon Chemistry	Draw structural formulas for up to ten carbon chains of simple hydrocarbons.	364 394 395	carbon chains photosynthesis and carbon reactions fossil fuels and carbon reactions	162 162 162	carbon reactions and the environment structure of fossil fuels importance of fossil fuels
C5.08B Chemistry	Changes in Matter	Carbon Chemistry	Draw isomers for simple hydrocarbons.	364 394 395	carbon chains photosynthesis and carbon reactions fossil fuels and carbon reactions	162 162 162	carbon reactions and the environment structure of fossil fuels importance of fossil fuels
C5.08C Chemistry	Changes in Matter	Carbon Chemistry	Recognize that proteins, starches, and other large biological molecules are polymers.	394 395 487 487 488	photosynthesis and carbon reactions fossil fuels and carbon reactions simple sugars are transported to cells biomolecules and energy fats proteins and carbohydrates	162 162	structure of fossil fuels importance of fossil fuels

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
P2.01A Physics	Motion of Objects	Position — Time	Calculate the average speed of an object using the change of position and elapsed time.	14	how to calculate speed	8	calculating speed
				20	calculate speed of car	9	collect data and calculate speed of car
				20	find speed of bumblebee	10	calculate speed of the car
				24	accurate speed measurements	12	find speed of car at different positions
				32	average speed vs. instantaneous	14	calculate speed of car at two places on the ramp
				32	average speed discussed	17	calculate speed of car
				42	calculate speed from distance/time graph	36	find speed of marble
P2.01B Physics	Motion of Objects	Position — Time	Represent the velocities for linear and circular motion using motion diagrams (arrows on strobe pictures).	15	compare and contrast speed and velocity		
P2.01C Physics	Motion of Objects	Position — Time	Create line graphs using measured values of position and elapsed time.	30	position vs. time graphs	13	make a 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.	30	position vs. time graphs	13	make a position vs. time graph

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
P2.01E Physics	Motion of Objects	Position — Time	Describe and classify various motions in a plane as one dimensional, two dimensional, circular, or periodic.	52 179 182 182 192	the effect of gravity what is a cycle? concept of frequency explained concept of period explained analyze systems to find cycle/period/frequency	20	investigate effect of gravity on motion
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.	32 52 52 54 55	average speed discussed gravity depends on mass the effect of gravity Newton's law of universal gravitation calculating gravitational force between objects	8 20	calculating speed investigate effect of gravity on motion
P2.02A Physics	Motion of Objects	Velocity — Time	Distinguish between the variables of distance, displacement, speed, velocity, and acceleration.	15 32 33 36	compare and contrast speed and velocity average speed discussed understanding acceleration examples of acceleration	8 12 14	calculating speed calculate speed of moving car acceleration is the rate at which speed changes

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
P2.02B Physics	Motion of Objects	Velocity — Time	Use the change of speed and elapsed time to calculate the average acceleration for linear motion.	35	how to calculate acceleration	12	calculate speed of moving car
				41	find acceleration of car	14	calculate acceleration of car on ramp
				49	link between force and acceleration	17	explore 2nd law and acceleration
				53	acceleration due to gravity		
P2.02C Physics	Motion of Objects	Velocity — Time	Describe and analyze the motion that a velocity-time graph represents, given the graph.	37	speed vs. time graphs	15	make 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.	36	examples of acceleration		
P3.01A Physics	Forces and Motion	Basic Forces in Nature	Identify the force(s) acting between objects in “direct contact” or at a distance.	45	Newton’s third law summarized	19	find correct relationship between force mass and acceleration
				46	force has potential to change motion	23	using 3rd law to explain common phenomena
				49	force is related to acceleration		
				59	Newton’s third law in detail		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
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).	47 weight vs. mass 51 net force explained 52 the effect of gravity 53 how to calculate weight 56 friction explained 64 research effect of friction on human joints	20 weight vs. mass 20 investigate effect of gravity on motion 21 effect of friction on the car
P3.02B Physics	Forces and Motion	Net Forces	Compare work done in different situations.	83 how to calculate work 87 concept of energy as stored work 96 calculate work done 97 calculate work accomplished by a motor 97 compare different amounts of work done 488 work vs. calories used by the body 488 work vs. calories used by the body 491 work and mechanical systems	31 calculate work done on block
P3.02C Physics	Forces and Motion	Net Forces	Calculate the net force acting on an object.	51 net force explained	

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page		Volume 2 Investigation Manual page	
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).	45	Newton's third law summarized	22	car and ramp and Newton's 3rd law
				59	Newton's third law in detail	23	using 3rd law to explain common phenomena
P3.04A Physics	Forces and Motion	Forces and Acceleration	Predict the change in motion of an object acted on by several forces.	46	force has potential to change motion	16	unbalanced forces and acceleration of car
				49	force is related to acceleration	19	discover 2nd law of motion
				51	balanced and unbalanced forces	19	find correct relationship between force mass and acceleration
				64	solving problems using $f=ma$		
P3.04B Physics	Forces and Motion	Forces and Acceleration	Identify forces acting on objects moving with constant velocity (e.g., cars on a highway).	15	compare and contrast speed and velocity	19	find correct relationship between force mass and acceleration
				46	force has potential to change motion		
				49	force is related to acceleration		
P3.04C Physics	Forces and Motion	Forces and Acceleration	Solve problems involving force, mass, and acceleration in linear motion (Newton's second law).	64	solving problems using $f=ma$	19	discover 2nd law of motion

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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).	52	the effect of gravity	20	investigate effect of gravity on motion
P3.06A Physics	Forces and Motion	Gravitational Interactions	Explain earth-moon interactions (orbital motion) in terms of forces.	52 54 55	gravity depends on mass Newton's law of universal gravitation calculating gravitational force between objects		
P3.06B Physics	Forces and Motion	Gravitational Interactions	Predict how the gravitational force between objects changes when the distance between them changes.	52 54 55	gravity depends on mass Newton's law of universal gravitation calculating gravitational force between objects		
P3.06C Physics	Forces and Motion	Gravitational Interactions	Explain how your weight on Earth could be different from your weight on another planet.	47 53 69	weight vs. mass how to calculate weight newtons and pounds	20 24	weight vs. mass measure force in newtons
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.	106 106	electrical force is incredibly strong! electrical forces		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
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.	105 charge is a fundamental property of matter 106 static charge discussed 107 explanation of coulomb 108 how an electroscope works 108 electroscopes	42 investigate electric charge
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.	88 potential and kinetic energy explained 90 conservation of energy explained 91 understand basic forms of energy 91 energy conversions 92 energy transformations and conservation 93 different forms of energy described 96 prove that energy is conserved	36 energy conservation and the roller coaster 37 investigating conservation of energy with rollercoaster 38 explore energy transformations 38 conservation of energy and energy transformations 39 identify type of energy involved 188 specific heat and conservation of energy

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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).	222	effect of medium on speed of sound wave	94	does sound behave like other waves?
				222	effect of temperature on speed of sound wave	119	investigate temperature and energy transfer in melting process
P4.02A Physics	Forms of Energy and Energy Transformations	Energy Transformation	Account for and represent energy transfer and transformation in complex processes (interactions).	85	some input work is converted to heat	36	energy conservation and the roller coaster
				91	following an energy transformation	38	identify potential/kinetic energy conversions
				91	energy conversions	38	explore energy transformations
				92	where does "spent" energy go?		
				96	explain the "lost" energy		
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).	164	what is an electromagnet?	66	build an electromagnet
				166	increased current vs. strength of magnetic field	67	find out what happens to strength of electromagnet when current is increased
				166	building an electromagnet		
				168	how electric motors work	68	investigate how an electric motor works
				170	dissecting an electric motor		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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).	88	potential and kinetic energy explained	37	investigating conservation of energy with rollercoaster
				90	conservation of energy explained	38	conservation of energy and energy transformations
				92	energy transformations and conservation	188	specific heat and conservation of energy
				93	different forms of energy described		
				96	prove that energy is conserved		
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.	84	work input and output	31	work output vs. work input
				85	some input work is converted to heat		
				92	where does "spent" energy go?		
				96	explain the "lost" energy		
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).	91	understand basic forms of energy	38	explore energy transformations
				91	energy conversions	39	identify type of energy involved

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
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).	91 following an energy transformation	38 identify potential/kinetic energy conversions
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.	84 work input and output	31 work output vs. work input
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.	197 transverse and longitudinal waves 198 frequency and wavelength and amplitude 205 standing waves on a string 215 properties of sound waves 221 importance of wavelength of sound waves 242 properties of light waves	82 study wave pulses on elastic cord 83 measure speed of a wave pulse 83 find speed of a wave 84 make different types of waves in a ripple tank 86 investigate frequency and wavelength 86 adjust frequency of a standing wave

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
P4.04B Physics	Forms of Energy and Energy Transformations	Wave Characteristics	Identify everyday examples of transverse and compression (longitudinal) waves.	197	transverse and longitudinal waves	82	study wave pulses on elastic cord
				198	frequency and wavelength and amplitude	83	measure speed of a wave pulse
				205	standing waves on a string	84	make different types of waves in a ripple tank
				215	properties of sound waves	86	investigate frequency and wavelength
				242	properties of 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.	221	importance of wavelength of sound waves	83	find speed of a wave
P4.05A Physics	Forms of Energy and Energy Transformations	Mechanical Wave Propagation	Identify everyday examples of energy transfer by waves and their sources.	195	waves transmit energy		
				196	waves are all around us		
				237	light waves and the electromagnetic spectrum		
				237	microwave ovens		
				237	radio and television signals		
				250	identify uses of electromagnetic waves		
				272	identify uses of electromagnetic waves		
474	energy and radiation relationships						

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>
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.	195 474 474	waves transmit energy electromagnetic radiation energy and radiation relationships	
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.	213 217 222 222	how the ear works loudness and decibels effect of medium on speed of sound wave effect of temperature on speed of sound wave	90 investigate human perception of sound 94 does sound behave like other waves?
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.	195 245 474	waves transmit energy we see color in terms of reflected light energy and radiation relationships	
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.	219 220 220 220 226	frequency of sound and pitch voice recognition programs white noise sonograms musical instruments	90 investigate human perception of sound 90 what is sound and how do we hear it? 98 investigate sound and music

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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.	237 237	visible light and the electromagnetic spectrum light waves and the electromagnetic spectrum	134	investigating visible light with a spectrometer
P4.06B Physics	Forms of Energy and Energy Transformations	Electromagnetic Waves	Explain why radio waves can travel through space, but sound waves cannot.	474	electromagnetic radiation		
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.	474	electromagnetic radiation		
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).	221	importance of wavelength of sound waves	83 86	find speed of a wave adjust frequency of a standing wave

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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.	258	forming images with lenses	106	tracing incident and reflected rays
				260	reflection and mirrors	107	investigate how light interacts with mirrors
				273	find the angle of reflection	107	plot reflected rays from a mirror
					107	investigate reflection of light	
					108	investigate how light interacts with a prism	
					108	explore refraction with lenses	
					110	finding focal point and focal length of a lens	
					111	plotting images formed when light is refracted by a lens	
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).	260	reflection and mirrors	106	tracing incident and reflected rays
				273	find the angle of reflection	107	investigate how light interacts with mirrors
						107	plot reflected rays from a mirror
						107	investigate reflection of light

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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.	258	refraction in optical systems	108	tracing incident and refracted rays
				263	index of refraction		
				263	index of refraction		
P4.09B Physics	Forms of Energy and Energy Transformations	Nature of Light	Explain how various materials reflect, absorb, or transmit light in different ways.	260	reflection and mirrors	107	plot reflected rays from a mirror
				476	absorption and emission	107	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.	242	color and frequency of light waves	101	observing white light through diffraction grating
						105	explore relationship between color and wavelength
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.	164	what is an electromagnet?	66	build an electromagnet
				166	increased current vs. strength of magnetic field	67	find out what happens to strength of electromagnet when current is increased
				166	building an electromagnet		
				172	generating electric power	201	investigate different methods of generating electricity
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.	120	ground fault circuit interrupter	48	measuring resistance
				123	understand the concept of electrical resistance		
				128	find and investigate circuit breakers in the home		
				136	potentiometer explained		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>		<b>Volume 2 Investigation Manual page</b>	
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.	102	concept of electric circuits	45	battery chemicals and electrical charge
				103	circuit diagrams	56	build a parallel circuit
				113	battery uses chemical energy to produce electrical charge	56	build a series circuit
				145	parallel circuit defined	58	build a series circuit and find total resistance
				145	series circuit defined	60	parallel circuit and Ohm's law
				146	household wiring		
				147	current and voltage in series circuits		
				151	voltage and resistance in parallel circuits		
				155	analyze a parallel circuit		
				156	analyze a series circuit		

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
Foundations of Physical Science Student Text and Investigation Manual**

<b>Standard #: Content Area</b>	<b>Standard</b>	<b>Content Statement</b>	<b>Performance expectation</b>	<b>Volume 1 Student Text page</b>	<b>Volume 2 Investigation Manual page</b>
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.	101 concept of electric current 114 voltage and potential energy 114 voltage is related to potential energy 115 how to measure voltage 117 electrical current explained 119 how to measure current 123 understand the concept of electrical resistance 131 Ohm's law explained 132 using Ohm's law to analyze circuits 136 potentiometer explained	44 investigate concept of voltage 46 investigate concept of electric current 48 measuring resistance 50 Ohm's law
P4.12A Physics	Forms of Energy and Energy Transformations	Nuclear Reactions	Describe peaceful technological applications of nuclear fission and radioactive decay.	393 carbon dating 393 radioisotopes in science and medicine 400 research pros and cons of nuclear technology	161 research pros and cons of uses for radioactive elements
P4.12B Physics	Forms of Energy and Energy Transformations	Nuclear Reactions	Describe possible problems caused by exposure to prolonged radioactive decay.	388 nuclear vs chemical reactions	138 nuclear reactions 160 how do you simulate nuclear decay?

**Correlation to Michigan Content Expectations: Essential - Chemistry and Physics  
*Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Content Area	Standard	Content Statement	Performance expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
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).	387 fusion and fission explained	138 fusion and fission