

Correlation to Colorado Grade 10 Science CSAP Framework
***Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page	Volume 2 Investigation Manual page
INQ.1.a 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		asking questions and stating hypotheses, using prior scientific knowledge to help guide their development;	10 the research question and hypothesis	6 formulate hypothesis 6 how do we ask questions and get answers from nature? 9 devise a hypothesis 34 formulate hypothesis 166 devise hypothesis and explain 166 which method will give fastest dissolving rate? 178 formulate hypothesis 198 formulate hypothesis 198 which type of food contains the most energy?

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Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page		Volume 2 Investigation Manual page	
INQ.1.b 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		creating and defending a written plan of action for a scientific investigation;	7	experimentation begins with a question	7	design your own experiment
				19	design your own experiment	9	design three experiments using car and ramp
				42	devise an experiment	16	decide how to vary the force on the car for this experiment
						26	what variables can be changed?
						75	design pendulum experiment
						93	decision trees and the advantage of doing multiple trials
						151	design experiment to find out if mass is conserved
						166	what three factors influence dissolving rate?

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INQ.1.c 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		selecting and using appropriate technologies to gather, process, and analyze data and to report information related to an investigation;	24 using an electronic timer	<p>data tables and graphs can be created on computer or graphing calculator</p> <p>7 use a ruler to make a measurement</p> <p>9 design three experiments and choose technology</p> <p>12 using photogates</p> <p>14 using photogates</p> <p>16 use a force scale</p> <p>17 use photogates to study car on ramp</p> <p>18 use a balance to find mass of car</p> <p>30 use force scale</p> <p>40 choose circuit parts to light a bulb</p> <p>44 using electrical meter</p> <p>46 using electrical meter</p> <p>48 using electrical meter</p> <p>50 using electrical meter</p> <p>86 use CPO Timer to measure frequency</p> <p>107 study reflection of laser beam</p>

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					108 study refraction of laser beam 113 trace critical angle with a laser beam 158 use a thermometer
INQ.1.d 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		identifying major sources of error or uncertainty within an investigation (for example, particular measuring devices and experimental procedures);	11 controlling variables in experiments 19 did you run a controlled experiment? 20 what factors could explain the variability in their data?	7 what variables should be controlled? 11 calculate % error 76 calculate % error 129 control the height of the liquid 165 what does the word "control" mean? 165 why was plain water tested?

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INQ.1.e 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		constructing and revising scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables;	11	control and experimental variables	7	doing a controlled experiment
				24	making a graph	13	graph distance vs. time
				26	independent and dependent variables	15	construct a quantitative graphical model
				26	creating graphs	21	construct reasonable explanation based on data
				41	make a graph	21	choose independent and dependent variables for graph
						27	recognize variables
						35	study data and determine importance of height on speed of marble
						37	organize data into a graph of speed vs. height
						45	analyze data and explain a rule
						51	graph voltage vs. current
		121	graph mass vs. volume				
		147	organize observations into a category table				
		151	does your experiment agree with law of conservation of mass?				
		157	add new rules to list based on findings				
		181	construct a graphical model				

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Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page	Volume 2 Investigation Manual page
					183 construct a temperature vs. time graph
INQ.1.f 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		communicating and evaluating scientific thinking that leads to particular conclusions;	10 process of reviewing hypothesis explained 24 interpretations of patterns in data 27 reading a graph 78 analyze lever diagram	15 interpret a speed vs. time graph 21 think about percent change 21 construct reasonable explanation based on data 35 what evidence is there in support of your hypothesis? 35 study data and determine importance of height on speed of marble 39 analyze energy transformations in different scenarios 45 analyze data and explain a rule 77 compare law of conservation of energy to motion of pendulum 151 review your hypothesis 151 do the data support the hypothesis 167 did you prove or disprove your hypothesis? 167 what was happening at molecular level?

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INQ.1.g 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		recognizing and analyzing alternative explanations and models; and	12	scientific results must be repeatable	14	multiple trials
				12	multiple experiment trials	18	evaluate graphs as to whether or not they show relationships between variables
				19	which group did the best experiment?	21	evaluate percent change for data collected
						63	perform multiple trials and average the results
						75	evaluate statistical significance
						157	add new rules to list based on findings
						167	evaluate method based on data

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INQ.1.h 9 - 12	Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.		explaining the difference between a scientific theory and a scientific hypothesis.	10 process of reviewing hypothesis explained	<p>35 what evidence is there in support of your hypothesis?</p> <p>39 critique group's explanation of energy transformations</p> <p>39 review energy theory in context of everyday scenarios</p> <p>39 analyze energy transformations in different scenarios</p> <p>77 show how energy loss data could be applied to designing a real clock</p> <p>77 compare law of conservation of energy to motion of pendulum</p> <p>151 review your hypothesis</p> <p>167 did you prove or disprove your hypothesis?</p>

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Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page	Volume 2 Investigation Manual page
INQ.5.a 9 - 12	Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.		analyzing benefits, limitations, costs, and consequences involved in using technology or resources (for example, X-rays, agricultural chemicals, natural gas reserves);	368 limiting reactants 379 research fuel cells 379 research economic impact of fuel cells 379 hydrogen-powered cars and the environment 379 research fuel cells 379 research environmental impact of fuel cells 395 fossil fuels 400 economic impact of pollution 400 economic impact of reducing air pollution 400 problems caused by airborne pollutants 421 wise use of water 430 water usage and quality 444 acid rain explained 448 research economic impact of producing gases that cause acid rain 448 research the issue of acid rain	163 economic impact of end-product of combustion reaction 163 too much CO2 163 research how trees offset accumulation of CO2 163 can trees compensate for manmade CO2 from vehicles and industry? 172 perform water quality tests 174 wise use of water supply 178 investigate effect of acid rain on microorganisms

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Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page	Volume 2 Investigation Manual page
INQ.5.b 9 - 12	Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.		analyzing how the introduction of a new technology has affected or could affect human activity (for example, invention of the telescope, applications of modern telecommunications);	444 acid rain explained 448 research the issue of acid rain	178 investigate effect of acid rain on microorganisms
INQ.5.c 9 - 12	Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.		demonstrating the interrelationships between science and technology (for example, building a bridge, designing a better running shoe); and	73 relationship between science and technology	70 using engineering design cycle
INQ.5.d 9 - 12	Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.		explaining the use of technology in an occupation.		174 water quality testing 177 chemistry and photography

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INQ.6.a 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		evaluating print and visual media for scientific evidence, bias, or opinion;	110	study appliance labels and instructions	76	analyze watch manufacturer's claims
				142	create pamphlet on utility's energy saver programs	162	inferences from promotional materials for vehicles
				434	study claims made by bottled water companies	173	study water filtration device claims

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INQ.6.b 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		explaining that the scientific way of knowing uses a critique and consensus process (for example, peer review, openness to criticism, logical arguments, skepticism);	12	scientific results must be repeatable	9	present conclusions to the class
				12	multiple experiment trials	14	multiple trials
				20	explain your reasoning	15	discuss and test ideas with your group
				73	impact of Da Vinci's work	19	explain how you arrived at your answer
						29	discuss what you learned about gears
						35	what evidence is there in support of your hypothesis?
						37	describe the flow of energy based on experimental graph
						39	critique group's explanation of energy transformations
						39	give a brief presentation to the class
						47	discuss an explanation with your group
		47	present and defend an explanation				
		63	perform multiple trials and average the results				
		77	show how energy loss data could be applied to designing a real clock				

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					129 explain your answer and justify 145 present findings and methods used 151 present results to the class 163 evaluating choice of favorite car
INQ.6.c 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		using graphs, equations, or other models to analyze systems involving change and constancy (for example, comparing the geologic time scale to shorter time frames);	24 making a graph 24 interpretations of patterns in data 26 creating graphs 27 reading a graph 41 make a graph 42 interpreting distance/time graph 78 analyze lever diagram	13 graph distance vs. time 15 construct a quantitative graphical model 15 interpret a speed vs. time graph 25 create a mathematical model 27 find math rule for lever equilibrium 28 derive a math formula 37 organize data into a graph of speed vs. height 51 graph voltage vs. current 121 graph mass vs. volume 147 organize observations into a category table 181 construct a graphical model 183 construct a temperature vs. time graph

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INQ.6.d 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		analyzing and comparing models of cyclic change as used within and among scientific disciplines (for example, water cycle, circular motion, sound waves, weather cycles);	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		
INQ.6.e 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		identifying and predicting cause-effect relationships within a system (for example, the effect of temperature on gas volume, effect of carbon dioxide level on the greenhouse effect, effects of changing nutrients at the base of a food pyramid);	28	identifying cause and effect relationships	21	determine effect of increasing mass
				41	identify cause and effect		
INQ.6.f 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		identifying and describing the dynamics of natural systems (for example, weather systems, ecological systems, body systems, systems at dynamic equilibrium);	51	what is equilibrium?		

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INQ.6.g 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		identifying and testing a model to analyze systems involving change and constancy (for example, a mathematical expression for gas behavior; constructing a closed ecosystem such as an aquarium);	23 why make models? 24 scientific models 24 what is a scientific model? 24 making a graph 26 creating graphs 41 make a graph 42 interpreting distance/time graph	13 graph distance vs. time 15 construct a quantitative graphical model 25 create a mathematical model 27 find math rule for lever equilibrium 28 derive a math formula 37 organize data into a graph of speed vs. height 51 graph voltage vs. current 121 graph mass vs. volume 147 organize observations into a category table 181 construct a graphical model 183 construct a temperature vs. time graph
INQ.6.h 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		explaining an exponential model (for example, pH scale, population growth, Richter scale); and		176 measure pH

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INQ.6.i 9 - 12	Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.		refining a hypothesis based on an accumulation of data over time (for example, Alvarez's theory on dinosaur extinction).	34	Aristotle vs. Newton	130 investigate Rutherford's gold foil experiment
				45	Newton's Laws of Motion	
				54	Newton and the force of gravity	
				105	Benjamin Franklin	
				107	Charles-Augustin Coulomb	
				312	contributions of Fermi	
				313	development of atomic theory	
				324	research and create a poster to illustrate development of atomic model	
				393	contributions of Marie and Pierre Curie	

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PS.2.1.a 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that matter has characteristic properties, which are related to its composition and structure.	examining, describing, measuring, classifying, and predicting common properties of substances (for example, electrical charge, chemical reactivity, acidity, electrical conductivity, radioactivity, relationships in the periodic table);	105	charge is a fundamental property of matter	42	investigate electric charge
				106	static charge discussed	138	nuclear reactions
				107	explanation of coulomb	141	build model of Na and Cl atoms and explain why they bond to form a molecule
				108	how an electroscope works	142	arrangement of electrons and groups of elements
				108	electroscopes	160	radioactive decay
				321	groups of elements and valence shells	160	how do you simulate nuclear decay?
				329	periodic table columns and valence electrons	176	investigate acids and bases
				330	bonding and periodic table position		
				332	periodic table and electronegativities		
				335	periodic table and oxidation numbers		
388	nuclear vs chemical reactions						

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PS.2.1.b 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that matter has characteristic properties, which are related to its composition and structure.	describing and explaining properties and composition of samples of matter using models (for example, atomic and molecular structure, the periodic table);	311	location/size/charge of subatomic particles	132	atomic number determines what element that atom is
				311	protons/neutrons/electrons	132	building atom models
				315	atoms of same element have same atomic number	133	using the periodic table
				318	proton/electron attraction	133	location of electrons in atom
				320	groups of elements	133	protons and neutrons
				321	studying the periodic table	136	building and studying the periodic table
				332	metals nonmetals and metalloids	136	model stable and neutral atoms
				388	showing valence electrons in a diagram	137	importance of atomic number
						137	build atomic models
						140	find the number of electrons in outermost level
		140	review subatomic particles				

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PS.2.1.c 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that matter has characteristic properties, which are related to its composition and structure.	separating substances based on their chemical and physical properties (for example, color, solubility, chemical reactivity, melting point, boiling point); and	278	mixtures can be separated by physical means	114	separating a homogeneous mixture
				284	changes of state	119	energy and phase changes
				291	density is independent of amount of substance	166	design experiments to explore dissolving rate
				292	elasticity is a physical property of matter	168	investigate solubility of sugar
				292	hardness is a physical property of matter	170	solubility and temperature
				293	brittleness is a physical property of matter		
				294	tensile strength is a physical property of matter		
				294	malleability is a physical property of matter		
				294	development of Kevlar brand fiber		
				406	molecular motion and dissolving rate		
				406	molecular motion and dissolving rate		
				407	surface area and dissolving rate		
				411	effect of temperature on solubility		

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PS.2.1.d 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that matter has characteristic properties, which are related to its composition and structure.	using word and chemical equations to relate observed changes in matter to its composition and structure.	336 writing a chemical formula 338 summary of chemical formula writing rules 339 naming compounds 371 which of the equations is balanced?	143 name chemical compounds 143 predict chemical formulas 145 determine empirical formula 149 balance these equations
PS.2.2.a 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).	identifying, measuring, calculating, and analyzing quantitative relationships involved with energy forms (for example, heat transfer in a system involving mass, specific heat, and change in temperature of matter); and	457 specific heat and the heat equation 458 specific heat 459 specific heat of different substances	

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PS.2.2.b 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).	identifying, measuring, calculating, and analyzing relationships associated with energy transfer (changes in temperature, velocity, potential energy, kinetic energy, conduction, convection, radiation, voltage, current).	32	average speed discussed	8	calculating speed
				36	examples of acceleration	36	energy conservation and the roller coaster
				91	following an energy transformation	38	identify potential/kinetic energy conversions
				101	concept of electric current	44	investigate concept of voltage
				102	concept of electric circuits	45	battery chemicals and electrical charge
				103	circuit diagrams	46	investigate concept of electric current
				113	battery uses chemical energy to produce electrical charge	50	Ohm's law
				114	voltage and potential energy	56	build a parallel circuit
				115	how to measure voltage	56	build a series circuit
				117	electrical current explained	58	build a series circuit and find total resistance
				119	how to measure current	60	parallel circuit and Ohm's law
				131	Ohm's law explained	119	investigate temperature and energy transfer in melting process
				132	using Ohm's law to analyze circuits	190	investigate conduction through all states of matter
				145	parallel circuit defined	192	investigate convection in liquids
				145	series circuit defined	194	investigate radiation emitted by solids
				146	household wiring		
				147	current and voltage in series circuits		
				151	voltage and resistance in parallel circuits		
155	analyze a parallel circuit						

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				156 analyze a series circuit	194 investigate radiation emitted by liquids
				452 temperature scales	
				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	

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PS.2.3.a 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.	identifying, describing, and explaining physical and chemical changes involving the conservation of matter and energy (for example, oscillating pendulum/spring, chemical reactions, nuclear reactions);	88	potential and kinetic energy explained	36	energy conservation and the roller coaster
				90	conservation of energy explained	37	investigating conservation of energy with rollercoaster
				92	energy transformations and conservation	38	conservation of energy and energy transformations
				93	different forms of energy described	150	investigate conservation of mass in effervescent tablet reaction
				96	prove that energy is conserved	188	specific heat and conservation of energy
				363	history of law of conservation of mass		

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PS.2.3.b 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.	observing, measuring, and calculating quantities to demonstrate conservation of matter and energy in chemical changes (for example, acid-base, precipitation reactions), and physical interactions of matter (for example, force, work, power);	68	compound machines	29	design and construct complex gear machines
				83	how to calculate work	31	calculate work done on block
				85	efficiency and bicycles	31	work = force X distance
				86	power explained	156	investigate double displacement reactions
				86	how to calculate power	158	measure energy changes in 3 different reactions
				87	concept of energy as stored work	176	measure pH
				96	decide whether or not work is done	176	investigate acids and bases
				96	calculate work done	185	find efficiency of water heater
				97	calculate power		
				97	analyze power of motor		
				97	calculate work output from efficiency data		
				97	compare different amounts of work done		
				97	calculate work accomplished by a motor		
				97	calculate power of two different machines		
				138	how to calculate electrical power		
				375	synthesis or addition reactions		
				376	decomposition reactions		
				377	double displacement reactions		

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				377 single displacement reactions	
				488 work vs. calories used by the body	
				488 work vs. calories used by the body	
				491 work and mechanical systems	

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PS.2.3.c 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.	describing and predicting chemical changes (for example, combustion, simple chemical reactions), and physical interactions of matter (for example, velocity, force, work, power),	13	speed is relative	9	collect data and calculate speed of car
				14	how to calculate speed	10	calculate speed of the car
				15	compare and contrast speed and velocity	12	find speed of car at different positions
				18	what is the speed of an object that is standing still?	13	make a position vs. time graph
				20	find speed of bumblebee	14	calculate speed of car at two places on the ramp
				20	calculate speed of car	15	make a speed vs. time graph
				24	accurate speed measurements	16	thinking about force
				25	conceptual models of motion	17	calculate speed of car
				30	position vs. time graphs	21	effect of friction on the car
				32	average speed vs. instantaneous	23	using 3rd law to explain common phenomena
				37	speed vs. time graphs	24	measure force in newtons
				42	calculate speed from distance/time graph	36	find speed of marble
				45	Newton's third law summarized	134	using a spectrometer
				45	Newton's first law summarized	135	observing different light sources with a spectrometer
				45	Newton's second law summarized	148	chemical equations
				48	Newton's first law in detail	156	investigate double displacement reactions
						162	carbon reactions and the environment

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				49	Newton's second law in detail	162	structure of fossil fuels
				56	friction explained	162	importance of fossil fuels
				59	Newton's third law in detail	162	investigating combustion reactions
				64	research effect of friction on human joints		
				69	newtons and pounds		
				319	fireworks displays and electron excitation		
				354	chemical reactions and digestion		
				357	combustion reaction		
				361	chemical reactions in living systems		
				361	heartburn reaction		
				364	carbon chains		
				375	synthesis or addition reactions		
				376	decomposition reactions		
				377	double displacement reactions		
				377	single displacement reactions		
				378	consumer chemistry		
				378	combustion reactions		
				381	MRE ration heater reaction		

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				394	photosynthesis and carbon reactions
				395	chemistry of the atmosphere
				395	chemistry of the atmosphere
				395	fossil fuels and carbon reactions
				397	carbon reactions
				444	chemical reactions and the formation of acid rain
				487	chemical reactions in living systems
				489	metabolism and stored energy

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PS.2.3.d 9 - 12	Physical Science: Students know and understand common properties, forms, and changes in matter and energy. (Focus: Physics and Chemistry)	Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.	describing and explaining physical interactions of matter using conceptual models (for example, conservation laws of matter and energy, particle model for gaseous behavior).	88	potential and kinetic energy explained	36	energy conservation and the roller coaster
				90	conservation of energy explained	37	investigating conservation of energy with rollercoaster
				91	energy conversions	38	explore energy transformations
				92	energy transformations and conservation	38	conservation of energy and energy transformations
				93	different forms of energy described	94	does sound behave like other waves?
				96	prove that energy is conserved	104	investigate RGB model of color
				196	waves are all around us	118	observe melting process and study quantitatively
				222	effect of medium on speed of sound wave	118	molecules in a liquid
				222	effect of temperature on speed of sound wave	118	investigate melting
				237	radio and television signals	119	adding heat energy to melt an ice cube
				237	microwave ovens	188	specific heat and conservation of energy
				243	RGB model of color		
				250	identify uses of electromagnetic waves		
				272	identify uses of electromagnetic waves		
				284	states of matter and arrangement of molecules		
285	characteristics of matter related to its state						

Correlation to Colorado Grade 10 Science CSAP Framework
***Foundations of Physical Science* Student Text and Investigation Manual**

Standard #: Grade	Standard	Objective	Benchmark	Volume 1 Student Text page	Volume 2 Investigation Manual page
				363 history of law of conservation of mass 451 increasing temperature means increasing motion of molecules	