

**Correlation to Illinois Learning Standards for Science
CPO Science Physical Science (Middle School)**

Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page		
11.A.3a Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Formulate hypotheses that can be tested by collecting data.	28	interpreting observations and proposing explanations	2	experiment to answer questions
				28	asking scientific questions	6	formulate testable hypothesis
				29	construct explanations supported by direct and indirect evidence	6	construct reasonable explanations supported by direct and indirect data
				33	formulate a testable hypothesis	7	interpreting observations and proposing explanations
				242	explanations based on observations	7	test hypothesis against observations
				270	interpreting observations and making explanations	8	which ramp is the fastest?
				404	construct explanations based on data	9	formulate testable hypothesis
				444	explanations based on evidence	9	test hypothesis against observations
						9	make hypothesis
						13	what kind of motion happens?
		14	explain using data				
		18	how does friction affect motion?				
		19	formulate a testable hypothesis				
		21	what happens when force is applied?				

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					23 how does acceleration depend on force and mass? 26 make testable hypothesis 26 where does the marble move the fastest? 31 why does it look like the moon's shape changes? 38 construct explanations based on evidence 39 what are the properties of magnetism? 40 constructing explanations 43 what variables affect the pendulum? 43 design scientific experiments 46 how is color created? 49 explanations based on evidence 50 how are temperature and heat related? 58 interpret observations 75 what is pH? 76 interpret observations 80 interpret observations

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11.A.3b Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Conduct scientific experiments that control all but one variable.	34	recognizing variables	3	identifying cause and effect relationships
				41	recognizing and controlling variables in observations and experiments	3	identify cause and effect relationships
				44	identifying cause and effect relationships	10	recognize and control variables
				45	identifying cause and effect relationships	13	conduct car/ramp experiment
				54	variables	24	cause and effect relationships
				61	identify cause and effect relationships—real and hypothesized	24	control variables
				62	identifying cause and effect relationships	43	recognizing and controlling variables
				63	identifying cause and effect relationships	43	design scientific experiments
						58	conduct scientific vocabulary
						80	recognizing and controlling variables

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11.A.3c Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Collect and record data accurately using consistent measuring and recording techniques and media.	11	balances	1	timers
				12	rulers	2	timers and photogates
				12	measurement	3	photogates
				24	balances	4	measurements
				42	collect data with precision as a central consideration	4	balances
				46	photogates	5	measurement and selecting appropriate tools
				48	precision of data	8	photogates
				54	photogates	13	selecting ramp and photogates
				56	timers	13	timers and photogates
				76	measurements	16	balances
				76	rulers	17	balances
				102	design experiments	18	timers and photogates
				184	measuring	19	photogates
				277	how a thermometer works	23	photogates
				294	thermometers	26	photogates
				299	graduated cylinder	42	photogates
				401	design experiment—including choosing equipment	43	photogates
				411	design experiment with appropriate equipment	49	measuring
				424	thermometers	50	collect data with precision as a central consideration
						51	balances

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					52 thermometers
					56 balances
					73 balances
					73 graduated cylinders
					77 measurements
					79 using balances
					88 goggles
					89 goggles and aprons
					90 goggles
					95 metric and English rulers
					95 measuring
					96 measuring
					96 metric rulers
					97 measuring
					97 metric rulers
					98 metric rulers
					98 measuring
					99 temperature measuring devices
					100 thermometers
					100 beakers
					101 rulers
					101 measurements

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					102 measurements 103 measurements 105 graduated cylinders 106 balances 107 balances 108 balances
11.A.3d Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Explain the existence of unexpected results in a data set.	24 percent of error 24 error in experiments 43 analysis of error 44 analysis of errors in both measurements and interpretation 45 analysis of errors in measurement 184 systematic error 444 use % to make conclusions	5 errors in data 5 analysis of errors in measurement

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11.A.3e Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Use data manipulation tools and quantitative (e.g., mean, mode, simple equations) and representational methods (e.g., simulations, image processing) to analyze measurements.	featured in Ancillary Skillsheet "Dimensional Analysis", "Ratios and Proportions", "Gear Ratios"	5 analysis of errors in measurement	
					8 average walking speed	
					8 average speed of cart	
					9 calculate speed	
					9 find average speed	
				24	percent of error	10 find average speed
				36	using algebraic models	14 construct a graphical model
				42	average, accuracy, and error	15 construct a graphical model
				43	analysis of error	17 make graph from data
				44	averages and significant differences	18 calculate average speed
				44	analysis of errors in both measurements and interpretation	22 make model from data
						27 calculate speed
				45	analysis of errors in measurement	27 making a graph from data
				45	find the average of a data set	29 find the mechanical advantage
				51	find the average of a data set	55 find average volume
60	graphs	56 find the mass/volume ratio				
61	making and evaluating graphs	58 average density				
		110 lab notebook				
		111 making graphs				

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				61	
				62	
				63	
				63	
				64	
				66	
				83	
				86	
				98	
				115	
				138	
				184	
				200	
				222	
				227	
				294	
				340	
				444	

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11.A.3f Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Interpret and represent results of analysis to produce findings.	42	basic statistical analysis of data—average	3	data tables
				45	basic statistical analysis	3	data tables
				48	data tables	4	data tables
				48	averages	6	data tables
				61	interpretations of patterns in data	9	data tables
				61	analyze trends from data	10	data tables
				76	line graphs	11	data tables
				76	data tables	14	data tables
				184	interpretations of patterns from data	15	data tables
				318	data tables	17	analyze trends from data
				318	oral presentation of results	17	data tables
				340	data tables	18	data tables
				340	line graphs	19	data tables
				364	common chemical reactions—rust	22	data tables
				404	data tables	22	data tables
				424	data tables	23	making measurements
						24	data tables
		27	data tables				
		28	data tables				
		29	data tables				
		30	data tables				
		34	data tables				

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					39 data tables
					42 data tables
					47 data tables
					49 data tables
					50 data tables
					51 data tables
					53 data tables
					54 data tables
					56 data tables
					57 data tables
					65 data tables
					69 data tables
					73 data tables
					76 data tables
					78 data tables
					79 data tables
					80 data tables
					83 data tables
					84 data tables
					94 data tables
					98 data tables
					110 data tables

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11.A.3g Scientific Investigation	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Report and display the process and results of a scientific investigation.	29	communication is important to science	32	communicating as essential to science
				76	line graphs	92	formal lab report
				269	communication as essential to science	93	communicating results is essential to science
				318	oral presentation of results	93	lab reports
				318	write up results	93	writing up results
				340	line graphs	94	lab report
				364	common chemical reactions—rust	94	writing up results
				380	writing up results	110	lab report
						111	making graphs
11.B.3a Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Identify an actual design problem and establish criteria for determining the success of a solution.	102	design experiments	43	design scientific experiments
				214	propose a solution to a problem		
				401	design experiment—including choosing equipment		
				411	design experiment with appropriate equipment		

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page		Volume 2 Investigation Manual page	
11.B.3b Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Sketch, propose and compare design solutions to the problem considering available materials, tools, cost effectiveness and safety	97	create and interpret dimensional drawings	13	selecting ramp and photogates
				99	dimensioned drawings	28	ropes and pulley safety
				102	design experiments	45	sketch the wave fronts
				214	propose a solution to a problem	75	safety
				401	design experiment—including choosing equipment	77	safety
				411	design experiment with appropriate equipment	86	lab safety
						87	lab safety
				411	design experiment with appropriate equipment	88	lab safety
				424	lab safety	89	lab safety
						90	lab safety
						91	lab safety
11.B.3c Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Select the most appropriate design and build a prototype or simulation.	7	testing models		
				7	design cycle		
				39	steps of design cycle		
				48	design and test a model to solve a problem		
				124	design and test a model that solves a problem		
				150	design a model to solve a problem		
				325	design and test model		

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11.B.3d Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Test the prototype using available materials, instruments and technology and record the data.	7	design cycle	1	timers
				11	balances	2	timers and photogates
				12	rulers	3	photogates
				24	balances	4	balances
				39	steps of design cycle	8	photogates
				46	photogates	13	timers and photogates
				54	photogates	16	balances
				56	timers	16	force scales
				76	rulers	17	balances
				277	how a thermometer works	18	timers and photogates
				294	thermometers	19	photogates
				299	graduated cylinder	23	photogates
				424	thermometers	26	photogates
						28	force scales
						29	force scales
		42	photogates				
		43	photogates				
		51	balances				
		52	thermometers				
		56	balances				
		73	balances				
		73	graduated cylinders				

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
					78 making observations 79 using balances 88 goggles 89 goggles and aprons 90 goggles 95 metric and English rulers 96 metric rulers 97 metric rulers 98 metric rulers 99 temperature measuring devices 100 thermometers 100 beakers 101 rulers 105 graduated cylinders 106 balances 107 balances 108 balances

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11.B.3e Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Evaluate the test results based on established criteria, note sources of error and recommend improvements.	24	percent of error	5	errors in data
				24	error in experiments	5	analysis of errors in measurement
				43	analysis of error		
				44	analysis of errors in both measurements and interpretation		
				45	analysis of errors in measurement		
				184	systematic error		
				444	use % to make conclusions		
11.B.3f Technological Design	Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.	Know and apply the concepts, principles and processes of scientific inquiry.	Using available technology, report the relative success of the design based on the test results and criteria.		featured in Ancillary Skillsheet "Using Computer Spreadsheets"	32	communicating as essential to science
				29	communication is important to science	92	formal lab report
				76	line graphs	93	communicating results is essential to science
				269	communication as essential to science	93	lab reports
				340	line graphs	94	lab report
				364	common chemical reactions—rust	110	lab report

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12.C.3a Physical Science	Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.	Know and apply concepts that describe properties of matter and energy and the interactions between them.	Explain interactions of energy with matter including changes of state and conservation of mass and energy.	5	conversion of energy types	26	transformation of energy from one form to another
				6	energy conversions	27	transformation of energy from one form to another
				10	distinguish between matter and energy	79	investigate law of conservation of mass
				10	conversion of energy	80	law of conservation of mass
				10	conservation of energy (i.e. potential and kinetic)		
				15	conversion of energy from one form to another		
				16	how energy flows in an ecosystem		
				16	conversion of energy from one form to another		
				128	energy defined		
				130	law of conservation of energy		
				131	conservation of energy		
				131	conversion of energy from potential to kinetic		
				134	conservation of energy in a broader context		
				149	conversions of energy		
				150	energy conversions		
356	how carbon cycles through an ecosystem						

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
				385 describe properties of true solutions—including roles of the solvent and solute	
				411 write balanced chemical equations	
				411 conservation of mass	
				412 write balanced chemical equations	
				413 balance equations	
				417 balance chemical equations	
				420 conservation of mass	
				421 balanced chemical reactions	
				431 how carbon cycles in an ecosystem	

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page		Volume 2 Investigation Manual page	
12.C.3b Physical Science	Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.	Know and apply concepts that describe properties of matter and energy and the interactions between them.	Model and describe the chemical and physical characteristics of matter (e.g., atoms, molecules, elements, compounds, mixtures).	18	molecular motion changed by addition of heat	59	Bohr model
				19	molecular motion changed by addition of heat	59	understand the structure of an atom based on protons and neutrons and electrons
				20	recognize that compounds are composed of elements	62	understand the structure of an atom based on protons and neutrons and electrons
				96	relationship between real materials and concepts of atoms	62	structure of an atom
				174	structure of atoms—electrons and protons and neutrons	69	structure of an atom
				281	heat energy and molecular motion	70	three subatomic particles—charge and mass
				303	explain the relationship between materials and the concepts of atoms	70	structure of an atom
				314	compounds composed of elements	96	length measurements
				324	atoms are made up of proton and neutron and electron		
				325	protons neutrons and electrons		

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Standard #: Area	State Goal	Learning Standard	Learning Expectation	Volume 1 Student Text page	Volume 2 Investigation Manual page
				326	
				329	
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				364	
				365	

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				368	
				387	
				409	
				410	
				410	

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12.D.3a Physical Science	Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.	Know and apply concepts that describe force and motion and the principles that explain them.	Explain and demonstrate how forces affect motion (e.g., action/reaction, equilibrium conditions, free-falling objects).	4	Newton's second law qualitative	18	investigate the effects of friction on motion of objects
				17	force as ability to change motion	19	investigate effects of friction on motion
				68	quantitative understanding of acceleration as a rate of change of velocity	20	effects of friction
				73	Newton's second law	21	balanced or unbalanced forces causing changes in motion
				79	changes in motion require force	21	force as an action that changes motion
				80	forces needed to change motion	23	Newton's second law
				80	understand force as an action with potential to change motion	24	quantitative understanding of Newton's second law
				87	effect of friction on motion	25	Newton's second law
				88	effects of friction on motion of objects		
				89	changes in motion require application of force		
				89	effects of friction on motion		
				90	effects of friction on motion		
				91	effects of friction		
				92	effects of friction		

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				93	
					effects of friction on motion
				94	net force
				95	balanced and unbalanced forces
				96	change in motion require force
				96	concept of net force
				97	quantitative understanding of force changing motion
				97	use concepts of balanced or unbalanced forces
				98	net force
				98	balanced and unbalanced forces
				99	net force
				99	net force
				99	effect of friction on motion
				99	unbalanced forces cause motion
				100	Newton's laws applied to real situations
				100	Newton's first law
				101	net force
				101	concept of forces

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				101	
				101	
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				115	
					Newton's second law—quantitative
				116	net force
				117	understand and use concept of balanced and unbalanced forces to create motion
				118	Newton's third law—action and reaction
				118	balanced and unbalanced forces
				119	Newton's third law—qualitative
				119	Newton's third law—qualitative
				120	Newton's second law—qualitative
				120	Newton's laws in terms of real situations—sports and cars
				121	Newton's third law
				121	effect of friction on objects
				122	third law and rockets
				123	Newton's laws and space travel
				124	Newton's first law
				124	Newton's third law

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				124	
					third law qualitative understanding
				124	
					Newton's second law
				124	
					force as ability to change motion
				136	
					understanding of force as the ability to change motion
				142	
					friction and machines
				144	
					simple machines and the human body
				221	
					friction and damping

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12.D.3b Physical Science	Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.	Know and apply concepts that describe force and motion and the principles that explain them.	Explain the factors that affect the gravitational forces on objects (e.g., changes in mass, distance).	70 effect of gravity on motion 72 projectile explained 82 effect of gravity on objects 96 effects of gravity 100 how gravity affects motion 100 gravity 154 Newton's law of universal gravitation 156 effect of gravity on motion 157 role of gravity in solar system 158 role of gravity in universe 160 effect of gravity on motion of objects	