

# SAMPLE K-12 SCIENCE CURRICULUM 2011

SC K-12.1 Comprehensive Science Standard – Inquiry, the Nature of Science, and Technology											
Students will combine scientific processes and knowledge with scientific reasoning and critical thinking to ask questions about phenomena and propose explanations based on gathered evidence.											
Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology	
SC2.1.1 Students will ask questions and conduct investigations that lead to observations and communication of findings.			SC5.1.1 Students will plan and conduct investigations that lead to the development of explanations.			SC8.1.1 Students will design and conduct investigations that will lead to descriptions of relationships between evidence and explanations.			SC12.1.1 Students will design and conduct investigations that lead to the use of logic and evidence in the formulation of scientific explanations and models.		
ABILITIES TO DO SCIENTIFIC INQUIRY	<b>Scientific Questioning:</b> Explore teacher generated questions that relate to a science topic <b>2.1.1.a</b>	<b>Scientific Questioning:</b> Recognize questions that relate to a science topic <b>2.1.1.a</b>	<b>Scientific Questioning:</b> Ask questions that relate to a science topic <b>2.1.1.a</b>	<b>Scientific Questioning:</b> Identify scientific questions that can be investigated <b>5.1.1a</b>	<b>Scientific Questioning:</b> Ask scientific questions that can be answered through investigations <b>5.1.1.a</b>	<b>Scientific Questioning:</b> Ask testable scientific questions <b>5.1.1.a</b>	<b>Scientific Questioning:</b> Formulate testable questions that lead to predictions and scientific investigations <b>8.1.1.a</b> Possible connections to: 8.2.3.a investigating ripple tanks 8.3.3.e investigating types of organisms found in different transects (defined areas) 8.4.2.b investigating properties of soil such as percolation rates 8.4.2.d such as investigations with a magnetic compass 8.4.2.e such as investigations with simple stream tables (e.g. a cake pan and sand)			<b>Scientific Questioning:</b> Formulate a testable hypothesis supported by prior knowledge to guide an investigation <b>12.1.1.a</b> 1. Questioning 2. Predicting e.g. (supporting standard 12.2.2.c) Have students contemplate examples of net forces influencing the motion of objects (such as different sized football players colliding, cars crashing). Have students formulate testable questions relating forces, mass, and motion. Ask students to predict the outcome of a testable scenario and explain why; create a testable hypothesis.	<b>Scientific Questioning:</b> Formulate a testable hypothesis supported by prior knowledge to guide an investigation <b>12.1.1.a</b> 1. Questioning 2. Predicting e.g. (supporting standard 12.3.1.c Cellular functions) Conduct an activity showing the reaction of CO <sub>2</sub> and bromothymol blue (BTB) by blowing through a straw into a beaker of water and BTB. Have students formulate testable questions about this activity and how it could relate to life forms in natural bodies of water. Ask students to predict what happens to CO <sub>2</sub> levels in natural bodies of water containing plants and animals and why; create a testable hypothesis.

Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
<p><b>Scientific Investigations:</b> Participate in simple, teacher-facilitated investigations <b>2.1.1.b</b></p>	<p><b>Scientific Investigations:</b> Conduct simple investigations <b>2.1.1.b</b></p>	<p><b>Scientific Investigations:</b> Conduct simple investigations <b>2.1.1.b</b> <b>Exclusions: Do not hold students responsible for dependent and independent variables.</b></p>	<p><b>Scientific Investigations:</b> Plan and conduct simple scientific investigations <b>5.1.1.b</b> <b>Exclusions: Do not hold students responsible for dependent and independent variables.</b></p>	<p><b>Scientific Investigations:</b> Plan and conduct simple scientific investigations <b>5.1.1.b</b> <b>Exclusions: Do not hold students responsible for dependent and independent variables.</b></p>	<p><b>Scientific Investigations:</b> Plan and conduct investigations and identify factors that have the potential to impact an investigation <b>5.1.1.b</b></p>	<p><b>Scientific Investigations:</b> Design and conduct logical and sequential investigations including repeated trials <b>8.1.1.b</b> <b>Possible connections to:</b> 8.2.3.a investigating ripple tanks 8.3.3.e investigating types of organisms found in different transects (defined areas)</p>			<p><b>Scientific Investigations:</b> Design and conduct logical and sequential scientific investigations with repeated trials and apply findings to new investigations <b>12.1.1.b</b> <b>1. Understand that multiple trials lead to more accurate results. e.g. (supporting standard 12.2.2.c)</b> Have students design and conduct an experiment to investigate their hypothesis regarding the relationship between force, mass, and motion.</p>	<p><b>Scientific Investigations:</b> Design and conduct logical and sequential scientific investigations with repeated trials and apply findings to new investigations <b>12.1.1.b</b> <b>1. Understand that larger, appropriately chosen samples produce more accurate estimates of the characteristics of the total population. e.g. (supporting standard 12.3.1.c Cellular functions)</b> Have students design and conduct an experiment to investigate their hypothesis. Teachers should have containers, BTB, live plants (such as elodea) and underwater animals (such as snails) available for student use.</p>
							<p><b>Scientific Controls and Variables:</b> Determine controls and use dependent (responding) and independent (manipulated) variables <b>8.1.1.c</b> <b>Possible connections to</b> 8.2.1.c investigations with melting and freezing points 8.2.1.f investigations with chemical reactions in a closed system (e.g. kitchen chemistry reactions in a balloon)</p>		<p><b>Scientific Controls and Variables:</b> Identify and manage variables and constraints <b>12.1.1.c</b> <b>1. Identify dependent (responding) and independent (manipulated) variables.</b> <b>2. Understand that only one variable should be manipulated at a time during an experiment.</b></p>	<p><b>Scientific Controls and Variables:</b> Identify and manage variables and constraints <b>12.1.1.c</b> <b>1. Identify dependent (responding) and independent (manipulated) variables.</b> <b>2. Understand that only one variable should be manipulated at a time during an experiment. e.g. (supporting standard 12.3.1.c cellular functions)</b> Have students identify the controls and variables in their design (such as beaker one containing plant and animal, beaker two contains animals only, beaker three contains plants only, and a control beaker without organisms).</p>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ABILITIES TO DO SCIENTIFIC INQUIRY (CON'T)	<b>Scientific Tools:</b> Explore the guided use of tools (e.g., hand lens, balance, nonstandard measurement tools) <b>2.1.1.c</b>	<b>Scientific Tools:</b> Use simple tools appropriately (e.g., observation and measurement tools) <b>2.1.1.c</b>	<b>Scientific Tools:</b> Select and use simple tools appropriately (e.g., observation and measurement tools) <b>2.1.1.c</b>	<b>Scientific Tools:</b> Use equipment correctly and accurately <b>5.1.1.c</b>	<b>Scientific Tools:</b> Select and use equipment correctly and accurately <b>5.1.1.c</b>	<b>Scientific Tools:</b> Select and use equipment correctly and accurately <b>5.1.1.c</b>		<b>Scientific Tools:</b> Select and use equipment appropriate to the investigation, demonstrate correct techniques <b>8.1.1.d</b> Possible connections to: 8.2.1.b selecting and using appropriate tools with investigations of temperature and volume 8.2.1.d selecting and using appropriate tools with investigations relating to properties and states of matter 8.2.1.f selecting and using appropriate tools with investigations with chemical reactions in a closed system (e.g. kitchen chemistry reactions in a balloon) 8.4.3.c selecting and using appropriate tools with investigations relating to weather		<b>Scientific Tools:</b> Select and use lab equipment and technology, appropriately and accurately <b>12.1.1.d</b>	<b>Scientific Tools:</b> Select and use lab equipment, and technology, appropriately and accurately <b>12.1.1.d</b>
	<b>Scientific Observations:</b> Using the five senses, describe objects, organisms, or events through pictures, words, and numbers <b>2.1.1.d</b>	<b>Scientific Observations:</b> Using the five senses, describe objects, organisms, or events through pictures, words, and numbers <b>2.1.1.d</b>	<b>Scientific Observations:</b> Describe objects, organisms, or events using pictures, words, and numbers <b>2.1.1.d</b>	<b>Scientific Observations:</b> Make observations and measurements <b>5.1.1.d</b>	<b>Scientific Observations:</b> Differentiate between relevant and non-relevant observations <b>5.1.1.d</b>	<b>Scientific Observations:</b> Make relevant observations and measurements <b>5.1.1.d</b>			<b>Scientific Observations:</b> Make qualitative and quantitative observations <b>8.1.1.e</b>	<b>Scientific Observations:</b> Use tools and technology to make detailed qualitative and quantitative observations <b>12.1.1.e</b> 1. Understand that measurement errors may affect results of calculations. 2. (supporting standard 12.2.2.c) Have equipment available (such as motion detectors, stop watches, scales, force probes) for students to measure their variables. Have students make observations that include qualitative descriptions (such as shape of object and texture of surface) and quantitative descriptions (such as time, rate, mass).	<b>Scientific Observations:</b> Use tools and technology to make detailed qualitative and quantitative observations <b>12.1.1.e</b> 1. Understand that measurement errors may affect results of calculations. e.g. (supporting standard 12.3.1.c) Have students use indicators to make observations that include qualitative descriptions (such as color change and contents in beaker) and quantitative descriptions (such as pH and temperature).

Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
<b>Scientific Data Collection:</b> Collect and record observations using pictures, words, and symbols (e.g., weather charts, birthdays, lost teeth) <b>2.1.1.e</b>	<b>Scientific Data Collection:</b> Collect and record observations using pictures, words, and symbols <b>2.1.1.e</b>	<b>Scientific Data Collection:</b> Collect and record observations <b>2.1.1.e</b>	<b>Scientific Data Collection:</b> Collect and organize data <b>5.1.1.e</b>	<b>Scientific Data Collection:</b> Collect and organize data <b>5.1.1.e</b>	<b>Scientific Data Collection:</b> Collect and organize data <b>5.1.1.e</b>			<b>Scientific Data Collection:</b> Record and represent data appropriately and review for quality, accuracy, and relevancy <b>8.1.1.f</b>	<b>Scientific Data Collection:</b> Represent and review collected data in a systematic, accurate, and objective manner <b>12.1.1.f</b>	<b>Scientific Data Collection:</b> Represent and review collected data in a systematic, accurate, and objective manner <b>12.1.1.f</b>
			<b>Scientific Interpretations, Reflections, and Applications:</b> Develop a reasonable explanation based on collected data (teacher guided) <b>5.1.1.f</b>	<b>Scientific Interpretations, Reflections, and Applications:</b> Develop a reasonable explanation based on collected data (teacher guided) <b>5.1.1.f</b>	<b>Scientific Interpretations, Reflections, and Applications:</b> Develop a reasonable explanation based on collected data <b>5.1.1.f</b>			<b>Scientific Interpretations, Reflections, and Applications:</b> Evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information <b>8.1.1.g</b>	<b>Scientific Interpretations, Reflections, and Applications:</b> Analyze and interpret data, synthesize ideas, formulate and evaluate models, and clarify concepts and explanations <b>12.1.1.g</b> 1. Understand that a model is a physical, mental, or mathematical representation to show how objects and processes are connected. 2. Evaluate the reasonableness of answer to questions. 3. Understand that a correlation between two variables does not mean that either one causes the other. 4. Compare data for two groups by using averages and ranges of values. 5. Describe rate of change by comparing one measured quantity to another measured quantity. 6. Investigate and describe how different characteristics, properties, or relationships within a system change as their dimensions increase or decrease. 7. Test the usefulness of the model by comparing its prediction to actual observations.	<b>Scientific Interpretations, Reflections, and Applications:</b> Analyze and interpret data, synthesize ideas, formulate and evaluate models, and clarify concepts and explanations <b>12.1.1.g</b> 1. Understand that a model is a physical, mental, or mathematical representation to show how objects and processes are connected. 2. Evaluate the reasonableness of answer to questions. 3. Understand that a correlation between two variables does not mean that either one causes the other. 4. Compare data for two groups by using averages and ranges of values. 5. Describe rate of change by comparing one measured quantity to another measured quantity. 6. Investigate and describe how different characteristics, properties, or relationships within a system change as their dimensions increase or decrease. 7. Test the usefulness of the model by comparing its prediction to actual observations.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ABILITIES TO DO SCIENTIFIC INQUIRY (CON'T)										<b>Scientific Interpretations, Reflections, and Applications:</b> Use results to verify or refute a hypothesis <b>12.1.1.h</b>	<b>Scientific Interpretations, Reflections, and Applications:</b> Use results to verify or refute a hypothesis <b>12.1.1.h</b>
										<b>Scientific Interpretations, Reflections, and Applications:</b> Propose and/or evaluate possible revisions and alternate explanations <b>12.1.1.i</b> 1. (supporting standard 12.2.2.c) Have students examine their own experiment for possible revisions (such as not accounting for friction).	<b>Scientific Interpretations, Reflections, and Applications:</b> Propose and/or evaluate possible revisions and alternate explanations <b>12.1.1.i</b> e.g. (supporting standard 12.3.1.c) Have students examine their own experiment for possible revisions (such as not accounting for differences in light levels).
	<b>Scientific Communication:</b> Use drawings and words to describe and share observations with others <b>2.1.1.f</b>	<b>Scientific Communication:</b> Use drawings and words to describe and share observations with others <b>2.1.1.f</b>	<b>Scientific Communication:</b> Use drawings and words to describe and share observations with others <b>2.1.1.f</b>	<b>Scientific Communication:</b> Share information, procedures, and results with peers and/or adults <b>5.1.1.g</b>	<b>Scientific Communication:</b> Share information, procedures, and results with peers and/or adults <b>5.1.1.g</b>	<b>Scientific Communication:</b> Share information, procedures, and results with peers and/or adults <b>5.1.1.g</b>	<b>Scientific Communication:</b> Share information, procedures, results, and conclusions with appropriate audiences <b>8.1.1.h</b> Possible connections to: 8.2.1.c investigations with melting and freezing points 8.2.1.f investigations with chemical reactions in a closed system (e.g. kitchen chemistry reactions in a balloon) 8.2.1.d selecting and using appropriate tools with investigations relating to properties and states of matter 8.4.3.c selecting and using appropriate tools with investigations relating to weather		<b>Scientific Communication:</b> Share information, procedures, results, conclusions, and defend findings to a scientific community (peers, science fair audience, policy makers) <b>12.1.1.j</b> e.g. (supporting standard 12.2.2.c) Make predictions based on relationships among net force, mass, and acceleration). Have students share and defend their experimental conclusions to their peers; encourage peers to critically evaluate each experiment.	<b>Scientific Communication:</b> Share information, procedures, results, conclusions, and defend findings to a scientific community (peers, science fair audience, policy makers) <b>12.1.1.j</b> e.g. (supporting standard 12.3.1.c) Have students share and defend their experimental conclusions on rates of photosynthesis to their peers; encourage peers to critically evaluate each experiment.	

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ABILITIES TO DO SCIENTIFIC INQUIRY (CON'T)				<b>Scientific Communication:</b> Provide feedback on previously conducted scientific investigations such as class experiments or appropriate science publications <b>5.1.1.h</b>	<b>Scientific Communication:</b> Provide feedback on previously conducted scientific investigations such as class experiments or appropriate science publications <b>5.1.1.h</b>	<b>Scientific Communication:</b> Provide feedback on previously conducted scientific investigations such as class experiments or appropriate science publications <b>5.1.1.h</b>		<b>Scientific Communication:</b> Analyze and provide appropriate critique of scientific investigations <b>8.1.1.i</b> <b>Possible connections to:</b> 8.2.1.c investigations reflecting on or related to melting and freezing points 8.2.1.f investigations with chemical reactions in a closed system (e.g. kitchen chemistry reactions in a balloon)		<b>Scientific Communication:</b> Evaluate scientific investigations and offer revisions and new ideas as appropriate <b>12.1.1.k</b> 1. Asking further questions 2. Determining possible applications 3. Evaluating experimental design of others	<b>Scientific Communication:</b> Evaluate scientific investigations and offer revisions and new ideas as appropriate <b>12.1.1.k</b> 1. Asking further questions 2. Determining possible applications 3. Evaluating experimental design of others
	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>2.1.1.g</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>2.1.1.g</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>2.1.1.g</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>5.1.1.i</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>5.1.1.i</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>5.1.1.i</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>8.1.1.j</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>8.1.1.j</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>8.1.1.j</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>12.1.1.l</b>	<b>Mathematics:</b> Use appropriate mathematics in all aspects of scientific inquiry <b>12.1.1.l</b>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
NATURE OF SCIENCE				SC5.1.2 Students will describe how scientists go about their work.			SC8.1.2 Students will apply the nature of science to their own investigations.			SC12.1.2 Students will apply the nature of scientific knowledge to their own investigations and in the evaluation of scientific explanations.	
				<b>Scientific Knowledge:</b> Recognize that scientific explanations are based on evidence <b>5.1.2.a</b>	<b>Scientific Knowledge:</b> Recognize that scientific explanations are based on evidence and scientific knowledge <b>5.1.2.a</b>	<b>Scientific Knowledge:</b> Recognize that scientific explanations are based on evidence and scientific knowledge <b>5.1.2.a</b>	<b>Nature of Science</b> (8.1.2) is included in the 7 <sup>th</sup> and 8 <sup>th</sup> grade sample curriculum	<b>Scientific Knowledge:</b> Recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations <b>8.1.2.a</b> <b>Possible connections to:</b> 8.2.1.b examples could include discrepant events related to physical properties modeling how new experimental evidence may not match existing knowledge. 8.3.1.b discovery of cells due to the invention of the microscope		<b>Scientific Knowledge:</b> Recognize that scientific explanations must be open to questions, possible modification, and must be based upon historical and current scientific knowledge <b>12.1.2.a</b> 12.2.1.f subatomic particles 12.4.1.a Big Bang Theory 12.4.2.b plate tectonics	<b>Scientific Knowledge:</b> Recognize that scientific explanations must be open to questions, possible modification, and must be based upon historical and current scientific knowledge <b>12.1.2.a</b> e.g. (supporting standards) 1. 12.3.1.b the evolution of sub-cellular organelles (introduction of mitochondria into cells) 2. 12.3.4.c students can examine the changing thoughts of scientists as new evidence becomes available regarding the ancestry of living organisms (such as that between modern birds and dinosaurs)
				<b>Science and Society:</b> Recognize that new discoveries are always being made which impact scientific knowledge <b>5.1.2.b</b>	<b>Science and Society:</b> Recognize that new discoveries are always being made which impact scientific knowledge <b>5.1.2.b</b>	<b>Science and Society:</b> Recognize that new discoveries are always being made which impact scientific knowledge <b>5.1.2.b</b>			<b>Science and Society:</b> Describe how scientific discoveries influence and change society <b>8.1.2.b</b> <b>Possible connection to:</b> 8.1.3.g describe how science and technology are reciprocal 8.1.3.h recognize that solutions have intended and unintended consequences 8.3.3.g positive and negative effects of natural and human activity on an ecosystem 8.4.2.h classify Earth materials as renewable or nonrenewable	<b>Science and Society:</b> Describe how society influences the work of scientists and how science, technology, and current scientific discoveries influence and change society <b>12.1.2.b</b>	<b>Science and Society:</b> Describe how society influences the work of scientists and how science, technology, and current scientific discoveries influence and change society <b>12.1.2.b</b> e.g. (supporting standard 12.3.2.b Basic structure of DNA, Inheritance) Genetic characteristics led scientists to develop the technology to investigate and decode genomes. New discoveries uncovered allow scientists, individuals and society to potentially manipulate genes.

NATURE OF SCIENCE (CON'T)	<b>Kindergarten</b>	<b>First Grade</b>	<b>Second Grade</b>	<b>Third Grade</b>	<b>Fourth Grade</b>	<b>Fifth Grade</b>	<b>Sixth Grade</b>	<b>Seventh Grade</b>	<b>Eighth Grade</b>	<b>Physical Science</b>	<b>Biology</b>
				<b>Science as a Human Endeavor:</b> Recognize many different people study science <b>5.1.2.c</b>	<b>Science as a Human Endeavor:</b> Recognize many different people study science <b>5.1.2.c</b>	<b>Science as a Human Endeavor:</b> Recognize many different people study science <b>5.1.2.c</b>		<b>Science as a Human Endeavor:</b> Recognize scientists from various cultures have made many contributions to explain the natural world <b>8.1.2.c</b>		<b>Science as a Human Endeavor:</b> Recognize that the work of science results in incremental advances, almost always building on prior knowledge, in our understanding of the world <b>12.1.2.c</b> e.g. (supporting standard 12.4.2.b) Students will examine the development of the theory of plate tectonics.	<b>Science as a Human Endeavor:</b> Recognize that the work of science results in incremental advances, almost always building on prior knowledge, in our understanding of the world <b>12.1.2.c</b> e.g. (supporting standard 12.3.1.b) The incremental development of microscopes (from Leeuwenhoek's first microscope to modern electron microscopes) has lead scientists to a better understanding of the structure and function of cells.
											<b>Science as a Human Endeavor:</b> Research and describe the difficulties experienced by scientific innovators who had to overcome commonly held beliefs of their times to reach conclusions that we now take for granted <b>12.1.2.d</b> e.g. (supporting standard 12.3.4.b) Students will examine the adversity Charles Darwin encountered while communicating his theory of evolution through natural selection.

TECHNOLOGY	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
				SC5.1.3 Students will solve a simple design problem.			SC8.1.3 Students will solve a design problem which involves one or two science concepts.		SC12.1.3 Students will solve a complex design problem.		
					<b>Abilities to do Technical Design:</b> Identify a simple problem <b>5.1.3.a</b>			<b>Technology</b> (8.1.3) is included in the 8 <sup>th</sup> grade sample curriculum to streamline the 6-8 content standards and to align with indicators related to forces and motion.	<b>Abilities to do Technical Design:</b> Identify problems for technical design <b>8.1.3.a</b>		
					<b>Abilities to do Technical Design:</b> Propose a solution to a simple problem <b>5.1.3.b</b>				<b>Abilities to do Technical Design:</b> Design a solution or product <b>8.1.3.b</b>	<b>Abilities to do Technical Design:</b> Propose designs and choose between alternative solutions of a problem <b>12.1.3.a</b> e.g. (supporting standard 12.2.3) Have students design a Rube-Goldberg-like device to accomplish a given simple task (such as ejecting a ping-pong ball) while going through several different energy transformations.	
										<b>Abilities to do Technical Design:</b> Assess the limits of a technical design <b>12.1.3.b</b> e.g. (supporting standard 12.2.3.i conservation of energy) Students will recognize that no device can undergo perpetual motion (such as a car running off the power of the air resistance it generates when driving forward); energy is always conserved.	
				<b>Abilities to do Technical Design:</b> Implement the proposed solution <b>5.1.3.c</b>					<b>Abilities to do Technical Design:</b> Implement the proposed design <b>8.1.3.c</b>	<b>Abilities to do Technical Design:</b> Implement the selected solution <b>12.1.3.c</b> e.g. (supporting standard 12.2.3) Have students implement a Rube-Goldberg solution.	

TECHNOLOGY (CON'T)	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology	
						<b>Abilities to do Technical Design:</b> Evaluate the implementation <b>5.1.3.d</b>				<b>Abilities to do Technical Design:</b> Evaluate completed technological designs or products <b>8.1.3.d</b>	<b>Abilities to do Technical Design:</b> Evaluate the solution and its consequences <b>12.1.3.d</b> e.g. (supporting standard 12.2.3) Have students evaluate others' Rube-Goldberg solutions and identify possible consequences related to their technical design.	
						<b>Abilities to do Technical Design:</b> Communicate the problem, design, and solution <b>5.1.3.e</b>				<b>Abilities to do Technical Design:</b> Communicate the process of technical design <b>8.1.3.e</b>	<b>Abilities to do Technical Design:</b> Communicate the problem, process, and solution <b>12.1.3.e</b> e.g. (supporting standard 12.2.3) Students will present their device to their peers.	
										<b>Understanding of Technical Design:</b> Distinguish between scientific inquiry (asking questions about the natural world) and technological design (using science to solve practical problems) <b>8.1.3.f</b>	<b>Understanding of Technical Design:</b> Compare and contrast the reasons for the pursuit of science and the pursuit of technology <b>12.1.3.f</b>	
										<b>Understanding of Technical Design:</b> Describe how science and technology are reciprocal <b>8.1.3.g</b>	<b>Abilities to do Technical Design:</b> Explain how science advances with the introduction of new technology <b>12.1.3.g</b> e.g. (supporting standard 12.2.1.f) Students will explain how the observations by J.J. Thomson of a cathode ray tube and its interactions with a magnet led to the discovery of electrons and their charge.	
										<b>Understanding of Technical Design:</b> Recognize that solutions have intended and unintended consequences <b>8.1.3.h</b>	<b>Understanding of Technical Design:</b> Understand creativity, imagination, and a good knowledge base are all needed to advance the work of science and engineering <b>12.1.3.h</b>	
										<b>Understanding of Technical Design:</b> Compare and contrast the reporting of scientific knowledge and the reporting of technological knowledge <b>8.3.3.i</b>		

**SC K-12.2 Comprehensive Science Standard – Physical Science**

Students will integrate and communicate the information, concepts, principles, processes, theories, and models of the Physical Sciences to make connections with the natural and engineered world.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
	SC2.2.1 Students will observe and describe properties of objects and their behavior.			SC5.2.1 Students will explore and describe the physical properties of matter and its changes.			SC8.2.1 Students will identify and describe the particulate nature of matter including physical and chemical interactions.			SC12.2.1 Students will investigate and describe matter in terms of its structure, composition and conservation.	
MATTER	<b>Properties and Structure of Matter:</b> Observe physical properties of objects (color, size, shape) <b>2.2.1.a</b>	<b>Properties and Structure of Matter:</b> Observe physical properties of objects (texture, weight) <b>2.2.1.a</b>	<b>Properties and Structure of Matter:</b> Observe physical properties of objects (freezing, melting, sinking, and floating) <b>2.2.1.a</b>		<b>Properties and Structure of Matter:</b> Create simple mixtures and identify the physical properties of the individual substances which make up the mixture <b>5.2.1.a</b>	<b>Properties and Structure of Matter:</b> Identify pure substances and mixtures <b>5.2.1.a</b> Pure substances are matter that cannot be separated into other kinds of matter by any physical process. It has the same color, taste, texture, and composition. Mixtures are two or more substances mixed together but not combined chemically. Exclusion: Chemical properties and changes are addressed in the 6-8 band.		<b>Properties and Structures of Matter:</b> Describe physical and chemical properties of matter <b>8.2.1.b</b>			
	<b>Properties and Structure of Matter:</b> Sort objects by physical attributes (color, size, shape) <b>2.2.1.b</b>	<b>Properties and Structure of Matter:</b> Sort objects by physical attributes (texture, weight) <b>2.2.1.b</b>	<b>Properties and Structure of Matter:</b> Sort objects by physical attributes (freezing, melting, sinking, and floating) <b>2.2.1.b</b>	<b>Properties and Structure of Matter:</b> Identify and sort objects by physical properties of matter (color, odor, elasticity, weight, volume) <b>5.2.1.b</b>		<b>Properties and Structure of Matter:</b> Classify and categorize objects by multiple quantitative physical attributes (e.g., dimensions, mass, volume, temperature) <b>5.2.1.b</b> Exclusion: volume measures using cubic centimeters; force or weight measures using Newtons		<b>Properties and Structures of Matter:</b> Compare and contrast elements, compounds, and mixtures <b>8.2.1.a</b> The periodic table is used as a tool, not to be memorized. Exclusions: atomic structure, determination of chemical formulas, ionic and covalent bonding		<b>Properties and Structure of Matter:</b> Recognize bonding occurs when outer electrons are transferred (ionic) or shared (covalent) bonds <b>12.2.1.a</b>	
	<b>Properties and Structure of Matter:</b> Measure objects using comparative terms (heavier, lighter, longer, shorter) and non-standard units <b>2.2.1.c</b>	<b>Properties and Structure of Matter:</b> Measure objects using non-standard (e.g., paperclip length, pencil length) and standard (e.g., inches, centimeters) units <b>2.2.1.c</b>	<b>Properties and Structure of Matter:</b> Measure objects using simple tools (ruler, balance, hand lens, thermometer) and standard units to quantify characteristics <b>2.2.1.c</b>	<b>Properties and Structure of Matter:</b> Use size-appropriate metric measurements to describe physical properties <b>5.2.1.c</b>	<b>Properties and Structure of Matter:</b> Use size-appropriate metric measurements to describe physical properties <b>5.2.1.c</b>	<b>Properties and Structure of Matter:</b> Use size-appropriate metric measurements to describe physical properties <b>5.2.1.c</b>					
			<b>States of Matter:</b> Identify solids and liquids and recognize that liquids take the shape of their container <b>2.2.1.d</b> Exclusion: unusual substances (such as mud, toothpaste, or oobleck) that cannot be clearly classified	<b>States of Matter:</b> Identify physical properties of solids, liquids, and gases <b>5.2.1.d</b> Exclusion: plasma		<b>States of Matter:</b> Identify state changes caused by heating and cooling for solids, liquids, and gases <b>5.2.1.d</b>		<b>States of Matter:</b> Recognize most substances can exist as a solid, liquid, or gas depending on temperature <b>8.2.1.c</b> Exclusion: energy transfer		<b>States of Matter:</b> Describe the energy transfer associated with phase changes between solids, liquids, and gases <b>12.2.1.b</b> 1. Exclusions: mathematical calculations such as $Q=mCAT$	

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
MATTER (CON'T)								<b>States of Matter:</b> Compare and contrast solids, liquids, and gases based on properties of these states of matter <b>8.2.1.d</b>		<b>States of Matter:</b> Compare and contrast the three normal states of matter (solid, liquid, gas) in terms of energy, particle arrangement, particle motion, and strength of force of attraction between particles <b>12.2.1.c</b>	
								<b>Physical and Chemical Changes:</b> Recognize conservation of matter in physical and chemical changes <b>8.2.1.f</b>		<b>Physical and Chemical Changes:</b> Recognize a large number of chemical reactions involve the transfer of either electrons (oxidation/reduction) or hydrogen ions (acid/base) between reacting ions, molecules, or atoms <b>12.2.1.d</b>	
								<b>Physical and Chemical Changes:</b> Distinguish between physical and chemical changes (phase changes, dissolving, burning, rusting) <b>8.2.1.e</b> <i>Exclusions: chemical reaction rate, chemical equations</i>		<b>Physical and Chemical Changes:</b> Identify factors affecting rates of chemical reactions (temperature, particle size, surface area) <b>12.2.1.e</b>	
										<b>Atomic Structure:</b> Recognize the charges and relative locations of subatomic particles (neutrons, protons, electrons) <b>12.2.1.f</b>	
										<b>Atomic Structure:</b> Describe properties of atoms, ions, isotopes <b>12.2.1.g</b>	
									<b>Classification of Matter:</b> Classify substances into similar groups based on physical properties <b>8.2.1.g</b> <i>Exclusion: chemical properties and properties of atoms, ions, and isotopes</i>		<b>Classification of Matter:</b> Describe the organization of the periodic table of elements with respect to patterns of physical and chemical properties <b>12.2.1.h</b> <i>1. Exclusion: electron configuration</i>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
FORCE AND MOTION	SC2.2.2 Students will compare relative position and motion of objects.		SC5.2.2 Students will identify the influence of forces on motion.			SC8.2.2 Students will investigate and describe forces and motion.			SC12.2.2 Students will investigate and describe the nature of field forces and their interactions with matter.		
	<b>Motion:</b> State location and/or motion relative to another object or its surroundings (in front of, behind, between, over, under, up, and down) <b>2.2.2.a</b>	<b>Motion:</b> Describe how objects move in many different ways (straight, zigzag, round and round, back and forth, and fast and slow) <b>2.2.2.b</b>				<b>Motion:</b> Describe motion by tracing and measuring an object's position over a period of time (relative speed) <b>5.2.2.a</b> Exclusion: velocity, speed=distance/time and direction			<b>Motion:</b> Describe motion of an object by its position and velocity <b>8.2.2.a</b> Math is related to constant speed, speed=distance/time. Exclusions: acceleration	<b>Motion:</b> Describe motion with respect to displacement, velocity, and acceleration <b>12.2.2.a</b> 1. Be able to use and manipulate formulas such as $v=d/t$ or $a=\Delta v/\Delta t$ to solve for a variable	
									<b>Inertia/Newton's 1<sup>st</sup> Law:</b> Recognize examples of Newton's First Law, an object that is not being subjected to a force will continue to move at a constant speed in a straight line or stay at rest <b>8.2.2.b</b>	<b>Inertia/Newton's 1<sup>st</sup> Law:</b> Describe how the law of inertia (Newton's 1 <sup>st</sup> law) is evident in a real-world event <b>12.2.2.b</b> Use of student created examples of Newton's First Law with real-world examples.	
						<b>Forces/Newton's 2<sup>nd</sup> Law:</b> Describe changes in motion due to outside forces (push, pull, gravity) <b>5.2.2.b</b> Exclusion: friction			<b>Inertia/Newton's 2<sup>nd</sup> Law:</b> Compare the motion of objects related to the effects of balanced and unbalanced forces <b>8.2.2.c</b> Such as tug of war, large truck hits small car, etc. Exclusions: mathematical calculations using Newton's 2 <sup>nd</sup> Law ( $F=ma$ )	<b>Forces/Newton's 2<sup>nd</sup> Law:</b> Make predictions based on relationships among net force, mass, and acceleration (Newton's 2 <sup>nd</sup> law). <b>12.2.2.c</b> 1. Be able to use the formula $F=ma$ ; for example if the mass is doubled . . .	
										<b>Newton's 3<sup>rd</sup> Law:</b> Recognize that all forces occur in equal and opposite pairs (Newton's 3 <sup>rd</sup> law) <b>12.2.2.d</b>	
										<b>Newton's 3<sup>rd</sup> Law:</b> Describe how Newton's 3 <sup>rd</sup> law of motion is evident in a real-world event <b>12.2.2.e</b> 1. Exclusions: math calculations	

FORCE AND MOTION (CON'T)	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
				<b>Universal Forces:</b> Describe magnetic behavior in terms of attraction and repulsion <b>5.2.2.c</b>							
									<b>Universal Forces:</b> Recognize that everything on or around Earth is pulled toward Earth's center by gravitational force <b>8.2.2.d</b>	<b>Universal Forces:</b> Recognize gravity is a force each mass exerts on another mass, which is directly proportional to the masses and inversely proportional to the distance between them <b>12.2.2.f</b> 1. Describe the relationship between mass and distance in a conceptual manner without calculations. For example, as distance increases. . . or which would have more gravitational force or attraction between different sized objects. . .	
									<b>Universal Forces:</b> Recognize that an attractive or repulsive electric force exists between two charged particles and that this force is directly proportional to the magnitude of the charges and inversely proportional to the distance between <b>12.2.2.g</b> 1. Describe the relationship between charge and distance in a conceptual manner without calculations.		

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ENERGY				SC5.2.3 Students will observe and identify signs of energy transfer.			SC8.2.3 Students will identify and describe how energy systems and matter interact.			SC12.2.3 Students will describe and investigate energy systems relating to the conservation and interaction of energy and matter.	
					<b>Sound/Mechanical Waves:</b> Recognize that sound is produced from vibrating objects; that sound can be changed by changing the vibration <b>5.2.3.a</b>		<b>Sound/Mechanical Waves:</b> Recognize that vibrations set up wave-like disturbances that spread away from the source (sound, seismic, water waves) <b>8.2.3.a</b> For example use ripple tank, pebble in water, online seismic wave simulation to model wave motion			<b>Sound/Mechanical Waves:</b> Describe mechanical wave properties (speed, wavelength, frequency, amplitude) and how waves travel through a medium—be able to use and manipulate the formulate $v=f\lambda$ <b>12.2.3.a</b>	
							<b>Sound/Mechanical Waves:</b> Identify that waves move at different speeds in different materials <b>8.2.3.b</b> Exclusions: wave properties (speed calculations, wavelength, frequency, amplitude)				
										<b>Sound/Mechanical Waves:</b> Recognize that the energy in waves can be changed into other forms of energy <b>12.2.3.b</b>	
					<b>Light:</b> Recognize that light travels in a straight line and can be reflected by an object (mirror) <b>5.2.3.b</b>		<b>Light:</b> Recognize that light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection) <b>8.2.3.c</b> Exclusions: polarized light, fluorescent, phosphors, neon, index of refraction			<b>Light:</b> Recognize light can behave as a wave (diffraction and interference) <b>12.2.3.c</b>	

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ENERGY (CON'T)					<b>Light:</b> Recognize that light can travel through certain materials and not others (transparent, translucent, opaque) <b>5.2.3.c</b>		<b>Light:</b> Recognize that to see an object, light from the surface of the object must enter the eye; the color seen depends on the properties of the surface and the color of the available light sources <b>8.2.3.d</b> <b>Exclusions:</b> primary, complimentary colors and pigments				
										<b>Heat:</b> Distinguish between temperature (a measure of the average kinetic energy of atomic or molecular motion) and heat (the quantity of thermal energy that transfers due to a change in temperature) <b>12.2.3.d</b>	
						<b>Heat:</b> Identify ways to generate heat (e.g., friction, burning, incandescent light bulb) <b>5.2.3.d</b> <b>Exclusion:</b> thermal energy	<b>Heat:</b> Recognize that heat moves from warmer objects to cooler objects until both reach the same temperature <b>8.2.3.e</b>			<b>Heat:</b> Compare and contrast methods of heat transfer and the interaction of heat with matter via conduction, convection, and radiation <b>12.2.3.e</b>	
						<b>Heat:</b> Identify materials that act as conductors or insulators of heat <b>5.2.3.e</b>					
					<b>Electricity/Magnetism:</b> Recognize that the transfer of electricity in an electrical circuit requires a closed loop <b>5.2.3.f</b>						
											<b>Electricity/Magnetism:</b> Recognize that the production of electromagnetic waves is a result of changes in the motion of charges or by changing magnetic field <b>12.2.3.f</b> 1. Conceptual understanding only: for example when a change in magnetic or electrical field occurs, electromagnetic waves are produced.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ENERGY (CON'T)										<b>Electricity/Magnetism:</b> Compare and contrast segments of the electromagnetic spectrum (radio, micro, infrared, visible, ultraviolet, x-rays, gamma) based on frequency and wavelength <b>12.2.3.g</b>	
										<b>Nuclear:</b> Recognize that nuclear reactions (fission, fusion, and radioactive decay) convert a fraction of the mass of interacting particles into energy, and this amount of energy is much greater than the energy in chemical interactions <b>12.2.3.h</b> <a href="#">1. Conceptual understanding only</a>	
							<b>Conservation:</b> Describe transfer of energy from electrical and magnetic sources to different energy forms (heat, light, sound, and chemical) <b>8.2.3.f</b> <a href="#">Connects to 8.4.2.d</a>				
							<b>Conservation:</b> Recognize all energy is neither created nor destroyed <b>8.2.3.g</b> <a href="#">Relate to energy forms in 8.2.3.f</a> <b>Exclusions:</b> interpretation of Law of Conservation of Energy, kinetic, potential energy			<b>Conservation:</b> Interpret the law of conservation of energy to make predictions for the outcome of an event <b>12.2.3.i</b> <a href="#">includes kinetic and potential energy</a>	

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ENERGY (CON'T)										<b>Mechanical Energy:</b> Identify that all energy can be considered to be either kinetic, potential, or energy contained by a field (e.g., as electromagnetic waves) <b>12.2.3.j</b> 1. Be able to describe the relative amounts of potential and kinetic energy in a system such as a swing, a pendulum, etc. 2. Recognize that light, microwaves, radio waves, etc. are forms of energy. 3. Recognize that there are two models of energy described in this standard, Newtonian and Quantum.	
										<b>Chemical Energy:</b> Identify endothermic and exothermic reactions <b>12.2.3.k</b> 1. Conceptual understanding only	

**SC K-12.3 Comprehensive Science Standard – Life Science**

Students will integrate and communicate the information, concepts, principles, processes, theories, and models of the Life Sciences to make connections with the natural and engineered world.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
	SC2.3.1 Students will investigate the characteristics of living things.			SC5.3.1 Students will investigate and compare the characteristics of living things.			SC8.3.1 Students will investigate and describe the structure and function of living organisms.			SC12.3.1 Students will investigate and describe the chemical basis of the growth, development, and maintenance of cells.	
STRUCTURE AND FUNCTION OF LIVING SYSTEMS	<b>Characteristics of Life:</b> Differentiate between living and nonliving things <b>2.3.1.a</b>			<b>Characteristics of Life:</b> Compare and contrast characteristics of living and nonliving things <b>5.3.1.a</b> Examples: body covering, diet, locomotion				<b>Characteristics of Life:</b> Recognize the levels of organization in living organisms (cells, tissues, organs, organ systems, and organisms) <b>8.3.1.a</b>			<b>Characteristics of Life:</b> Identify the complex molecules (carbohydrates, fats, lipids, proteins, and nucleic acids) that make up living organisms <b>12.3.1.a</b>
								<b>Cellular Composition of Organisms:</b> Recognize that all organisms are composed of one or many cells; that these cells must grow, divide, and use energy; and that all cells function similarly <b>8.3.1.b</b> Exclusions: sub-cellular structures			<b>Cellular Composition of Organisms:</b> Identify the form and function of sub-cellular structures that regulate cellular activities <b>12.3.1.b</b>
								<b>Cellular Composition of Organisms:</b> Recognize specialized cells perform specialized functions in multi-cellular organisms <b>8.3.1.c</b>			<b>Cellular Composition of Organisms:</b> Describe the cellular functions of photosynthesis, respiration, cell division, protein synthesis, transport of materials, and energy capture/release <b>12.3.1.c</b> 1. Exclusions: Calvin cycle, Krebs cycle, glycolysis, and intermediate products in cellular respiration and photosynthesis.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
STRUCTURE AND FUNCTION OF LIVING SYSTEMS (CON'T)								<b>Cellular Composition of Organisms:</b> Identify the organs and functions of the major systems of the human body and describe ways that these systems interact with each other <b>8.3.1.d</b> The major systems of the human body include: circulatory, digestive, endocrine, excretory, immune, integumentary, nervous, muscular, reproductive, respiratory, and skeletal.			
	<b>Characteristics of Living Organisms:</b> Identify the basic needs of living things (food, water, air, space, shelter) <b>2.3.1.b</b>	<b>Characteristics of Living Organisms:</b> Identify external parts of plants and animals <b>2.3.1.c</b>	<b>Characteristics of Living Organisms:</b> Observe and match plants and animals to their distinct habitats <b>2.3.1.d</b> <i>Exclusion: ecosystem</i>	<b>Characteristics of Living Organisms:</b> Identify how parts of animals function to meet basic needs (e.g., leg of an insect helps an insect to move) <b>5.3.1.b</b>	<b>Characteristics of Living Organisms:</b> Identify how parts of plants function to meet basic needs (e.g., root of a plant helps the plant obtain water) <b>5.3.1.b</b>						
									<b>Characteristics of Life:</b> Describe how plants and animals respond to environmental stimuli <b>8.3.1.e</b>		<b>Behavior:</b> Describe how an organism senses changes in its internal and external environment and responds to ensure survival <b>12.3.1.d</b>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
HEREDITY	SC2.3.2 Students will recognize changes in living things.			SC5.3.2 Students will identify variations of inherited characteristics and life cycles.			SC8.3.2 Students will investigate and describe the relationship between reproduction and heredity.			SC12.3.2 Students will describe the molecular basis of reproduction and heredity.	
	<b>Inherited Traits:</b> Describe how offspring resemble their parents <b>2.3.2.a</b>			<b>Inherited Traits:</b> Identify inherited characteristics of animals <b>5.3.2.a</b>	<b>Inherited Traits:</b> Identify inherited characteristics of plants <b>5.3.2.a</b> Exclusion: process of photosynthesis			<b>Inherited Traits:</b> Recognize that hereditary information is contained in genes within the chromosomes of each cell <b>8.3.2.a</b> For example dominant, recessive, numbers of chromosomes from parents, etc. Exclusions: Punnett squares, pedigrees, DNA structure, protein synthesis			<b>Inherited Traits:</b> Identify that information passed from parents to offspring is coded in DNA molecules <b>12.3.2.a</b> 1. Include the inheritance of a trait over time.
											<b>Inherited Traits:</b> Describe the basic structure of DNA and its function in genetic inheritance <b>12.3.2.b</b>
											<b>Inherited Traits:</b> Recognize how mutations could help, harm, or have no effect on individual organisms <b>12.3.2.c</b>
	<b>Reproduction:</b> Describe how living things change as they grow <b>2.3.2.b</b>		<b>Reproduction:</b> Identify the life cycle of an organism (animals) <b>5.3.2.b</b> Exclusion: cells, cellular function; internal structures	<b>Reproduction:</b> Identify the life cycle of an organism (plants) <b>5.3.2.b</b> Exclusion: cells, cellular function; internal structures			<b>Reproduction:</b> Compare and contrast sexual and asexual reproduction <b>8.3.2.b</b> Exclusions: mitosis, meiosis			<b>Reproduction:</b> Describe that sexual reproduction results in a largely, predictable, variety of possible gene combinations in the offspring of any two parents <b>12.3.2.d</b> Includes Punnett Squares.	

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
FLOW OF MATTER AND ENERGY IN ECOSYSTEMS				SC5.3.3 Students will describe relationships within an ecosystem.			SC8.3.3 Students will describe populations and ecosystems.			SC12.3.3 Students will describe, on a molecular level, the cycling of matter and the flow of energy between organisms and their environment.	
					<b>Flow of Energy:</b> Diagram and explain a simple food chain beginning with the Sun <b>5.3.3.a</b> <i>Exclusion: process of photosynthesis</i>	<b>Flow of Energy:</b> Identify the roles of producers, consumers, and decomposers in an ecosystem <b>5.3.3.b</b>	<b>Flow of Energy:</b> Diagram and explain the flow of energy through a simple food web <b>8.3.3.a</b>				<b>Flow of Energy:</b> Explain how the stability of an ecosystem is increased by biological diversity <b>12.3.3.a</b>
							<b>Flow of Energy:</b> Compare the roles of producers, consumers, and decomposers in an ecosystem <b>8.3.3.b</b> <i>Builds on 5.3.3.b</i>				
							<b>Ecosystems:</b> Recognize that producers transform sunlight into chemical energy through photosynthesis <b>8.3.3.c</b> <i>Connects 8.4.3.a</i> <i>Exclusions: the chemical process of photosynthesis</i>				<b>Ecosystems:</b> Recognize atoms and molecules cycle among living and nonliving components of the biosphere <b>12.3.3.b</b> <i>1. Include the carbon, nitrogen, oxygen, and the water cycle. This also addresses 12.4.2.a</i>
						<b>Ecosystems:</b> Recognize the living and nonliving factors that impact the survival of organisms in an ecosystem <b>5.3.3.c</b> <i>Exclusions: predation, symbiosis, parasitism</i>			<b>Ecosystems:</b> Determine the biotic and abiotic factors that impact the number of organisms an ecosystem can support <b>8.3.3.d</b>		<b>Ecosystems:</b> Explain how distribution and abundance of different organisms in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials <b>12.3.3.c</b> <i>1. Include a description of natural influences on global climate, which addresses 12.4.3.d</i>
								<b>Ecosystems:</b> Recognize a population is all the individuals of a species at a given place and time <b>8.3.3.e</b>			

FLOW OF MATTER AND ENERGY IN ECOSYSTEMS (CON'T)	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
								<b>Ecosystems:</b> Identify symbiotic relationships among organisms <b>8.3.3.f</b>			
						<b>Impact on Ecosystems:</b> Recognize all organisms cause changes, some beneficial and some detrimental, in the environment where they live <b>5.3.3.d</b>			<b>Impact on Ecosystems:</b> Identify positive and negative effects of natural and human activity on an ecosystem <b>8.3.3.g</b>		<b>Impact on Ecosystems:</b> Analyze factors, which may influence environmental quality <b>12.3.3.d</b>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
BIODIVERSITY	SC2.3.4 Students will recognize changes in organisms.			SC5.3.4 Students will describe changes in organisms over time.			SC8.3.4 Students will identify characteristics of organisms that help them survive.			SC12.3.4 Students will describe the theory of biological evolution.	
			<b>Biological Adaptations:</b> Recognize seasonal changes in animals and plants <b>2.3.4.a</b>			<b>Biological Adaptations:</b> Describe adaptations made by plants or animals to survive environmental changes <b>5.3.4.a</b> <i>Exclusions: predation, symbiosis, parasitism, traits, species</i>			<b>Biological Adaptations:</b> Describe how an inherited characteristic enables an organism to improve its survival rate <b>8.3.4.a</b>		<b>Biological Adaptations:</b> Identify different types of adaptations necessary for survival (morphological, physiological, behavioral) <b>12.3.4.a</b>
									<b>Biological Evolution:</b> Recognize the extinction of a species is caused by the inability to adapt to an environmental change <b>8.3.4.b</b>		<b>Biological Evolution:</b> Recognize that the concept of biological evolution is a theory which explains the consequence of the interactions of: (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring <b>12.3.4.b</b>
									<b>Biological Evolution:</b> Use anatomical features of an organism to infer similarities among other organisms <b>8.3.4.c</b>		<b>Biological Evolution:</b> Explain how natural selection provides a scientific explanation of the fossil record and the molecular similarities among the diverse species of living organisms <b>12.3.4.c</b>
											<b>Biological Evolution:</b> Apply the theory of biological evolution to explain diversity of life over time <b>12.3.4.d</b>

**SC K-12.4 Comprehensive Science Standard – Earth and Space Sciences**

Students will integrate and communicate the information, concepts, principles, processes, theories, and models of Earth and Space Sciences to make connections with the natural and engineered world.

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
EARTH IN SPACE	SC2.4.1 Students will observe and identify objects of the sky.			SC5.4.1 Students will observe and describe characteristics, patterns, and changes in the sky.			SC8.4.1 Students will investigate and describe Earth and the solar system.			SC12.4.1 Students will investigate and describe the known universe.	
	<b>Objects in the Sky and Universe:</b> Identify objects in the sky (Sun, Moon, stars) and when they are observable <b>2.4.1.a</b>			<b>Objects in the Sky and Universe:</b> Recognize that the observed shape of the Moon changes from day to day during a one month period <b>5.4.1.a</b> <i>Exclusion: terms and content related to moon phases (e.g., waxing, waning, gibbous)</i>			<b>Objects in the Sky and Universe:</b> Describe the components of the solar system (the Sun, planets, moons, asteroids, comets) <b>8.4.1.a</b>			<b>Objects in the Sky and Universe:</b> Describe the formation of the universe using the Big Bang Theory <b>12.4.1.a</b>	
										<b>Objects in the Sky and Universe:</b> Recognize that stars, like the Sun, transform matter into energy by nuclear reactions, which leads to the formation of other elements <b>12.4.1.b</b> <i>1. Conceptual understanding only</i>	
										<b>Objects in the Sky and Universe:</b> Describe stellar evolution <b>12.4.1.c</b> <i>1. This includes formation and life cycles of stars</i>	
		<b>Motion of Objects in the Solar System:</b> Identify objects that appear to move in the sky (the Sun, the Moon, stars) <b>2.4.1.b</b> <i>Exclusion: movement of clouds, birds, airplanes, planets</i>					<b>Motion of Objects in the Solar System:</b> Recognize the motion of objects in the sky (the Sun, the Moon, stars) change over time in recognizable patterns <b>5.4.1.b</b> <i>Exclusion: observation of stars and galaxies; use of telescopes; ecliptic (use terms such as path of the Sun instead), planets, asteroids, comets</i>			<b>Motion of Objects in the Solar System:</b> Describe the relationship between motion of objects in the solar system and the phenomena of day, year, eclipses, phases of the Moon and seasons <b>8.4.1.b</b>	
									<b>Gravitational Effects:</b> Describe the effects of gravity on Earth (tides) and the effect of gravity on objects in the solar system <b>8.4.1.c</b>		

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
EARTH STRUCTURES AND PROCESSES	SC2.4.2 Students will observe, identify, and describe characteristics of Earth's materials.			SC5.4.2 Students will observe and describe Earth's materials, structure, and processes.			SC8.4.2 Students will investigate and describe Earth's structure, systems, and processes.			SC12.4.2 Students will investigate the relationships among Earth's structure, systems, and processes.	
		<b>Properties of Earth Materials:</b> Describe Earth materials (sand, soil, rocks, water) <b>2.4.2.a</b>		<b>Properties of Earth Materials:</b> Describe the characteristics of rocks, minerals, soils, water, and the atmosphere <b>5.4.2.a</b> <b>Exclusion: carbon dioxide and other specific component gases of the atmosphere</b>			<b>Properties of Earth Materials:</b> Describe the layers of Earth (core, mantle, crust, atmosphere) <b>8.4.2.a</b>	<b>Properties of Earth Materials:</b> Describe the mixture of gases in Earth's atmosphere and how the atmosphere's properties change at different elevations <b>8.4.2.c</b>			<b>Properties of Earth Materials:</b> Recognize how Earth materials move through geochemical cycles (carbon, nitrogen, oxygen) resulting in chemical and physical changes in matter <b>12.4.2.a</b> <b>1. Partially addressed in 12.3.3.b.</b>
							<b>Properties of Earth Materials:</b> Describe the physical composition of soil <b>8.4.2.b</b>				
							<b>Properties of Earth Materials:</b> Describe evidence of Earth's magnetic field <b>8.4.2.d</b> <b>Connects to 8.2.3.f, examples could include exploration with compass and aurora borealis</b>				
					<b>Earth's Processes:</b> Identify weathering, erosion, and deposition as processes that build up or break down Earth's surface <b>5.4.2.b</b>		<b>Earth's Processes:</b> Compare and contrast constructive and destructive forces (deposition, erosion, weathering, plate motion causing uplift, volcanoes, and earthquakes) that impact Earth's surface <b>8.4.2.e</b> <b>Builds on 5.4.4.a (4<sup>th</sup> and 5<sup>th</sup> grade in State Sample Curriculum)</b> <b>Exclusion: heat convection in mantle propels plates (why plates move)</b>			<b>Earth's Processes:</b> Describe how heat convection in the mantle propels the plates comprising Earth's surface across the face of the globe (plate tectonics) <b>12.4.2.b</b>	
							<b>Earth's Processes:</b> Describe the rock cycle <b>8.4.2.f</b> Rock types (igneous, metamorphic, sedimentary), formation, and changes over time				

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
EARTH STRUCTURES AND PROCESSES (CON'T)								<b>Earth's Processes:</b> Describe the water cycle (evaporation, condensation, precipitation) <b>8.4.2.g</b>			
			<b>Use of Earth Materials:</b> Recognize ways in which individuals and families can conserve Earth's resources by reducing, reusing, and recycling <b>2.4.2.b</b>			<b>Use of Earth Materials:</b> Identify how Earth materials are used (fuels, building materials, sustaining plant life) <b>5.4.2.c</b>			<b>Use of Earth Materials:</b> Classify Earth materials as renewable or nonrenewable <b>8.4.2.h</b> <a href="#">Connects to 8.3.3.g</a>		<b>Use of Earth Materials:</b> Evaluate the impact of human activity and natural causes on Earth's resources (groundwater, rivers, land, fossil fuels) <b>12.4.2.c</b>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
ENERGY IN EARTH'S SYSTEMS	SC2.4.3 Students will observe simple patterns of change on Earth.			SC5.4.3 Students will observe and describe the effects of energy changes on Earth.			SC8.4.3 Students will investigate and describe energy in Earth's systems.			SC12.4.3 Students will investigate and describe the relationships among the sources of energy and their effects on Earth's systems.	
			<b>Energy Sources:</b> Observe that the Sun provides heat and light <b>2.4.3.a</b>		<b>Energy Sources:</b> Describe the Sun's warming effect on the land and water <b>5.4.3.a</b>		<b>Energy Sources:</b> Describe how energy from the Sun influences the atmosphere and provides energy for plant growth <b>8.4.3.a</b> Describe greenhouse effect and define photosynthesis (exclusion chemical equation for photosynthesis) Connects to 8.3.3.c			<b>Energy Sources:</b> Describe how radiation, conduction, and convection transfer heat in Earth's systems <b>12.4.3.a</b>	
										<b>Energy Sources:</b> Identify internal sources of heat energy in Earth's systems <b>12.4.3.b</b> nuclear	<b>Energy Sources:</b> Identify external sources of heat energy in Earth's systems <b>12.4.3.b</b> solar
											<b>Energy Sources:</b> Compare and contrast benefits of renewable and nonrenewable energy sources <b>12.4.3.c</b>
	<b>Weather and Climate:</b> Observe and describe simple daily changes in weather <b>2.4.3.b</b>	<b>Weather and Climate:</b> Describe simple seasonal weather indicators and how they impact students' choices (activities, clothing) <b>2.4.3.c</b>							<b>Weather and Climate:</b> Identify factors that influence daily and seasonal changes on Earth (tilt of Earth, humidity, air pressure, air masses) <b>8.4.3.b</b>		
		<b>Weather and Climate:</b> Recognize the difference between weather, climate, and seasons <b>5.4.3.c</b> Exclusion: terms related to pressure, humidity, and long-term climate trends				<b>Weather and Climate:</b> Observe, measure, and record changes in weather (temperature, wind direction and speed, precipitation) <b>5.4.3.b</b> Exclusion: use of barometer to measure pressure or instruments to measure humidity		<b>Weather and Climate:</b> Describe atmospheric movements that influence weather and climate (air masses, jet stream) <b>8.4.3.c</b>			<b>Weather and Climate:</b> Describe natural influences (Earth's rotation, mountain ranges, oceans, differential heating) on global climate <b>12.4.3.d</b> 1. This could be addressed when teaching about biomes. <b>12.3.3.c</b>

	Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade	Physical Science	Biology
EARTH'S HISTORY				SC5.4.4 Students will describe changes in Earth.			SC8.4.4 Students will use evidence to draw conclusions about changes in Earth.			SC12.4.4 Students will explain the history and evolution of Earth.	
					<b>Past/Present Earth:</b> Describe how slow processes (erosion, weathering, deposition) change Earth's surface <b>5.4.4.a</b> <b>Exclusion: plate tectonics and mountain building</b>	<b>Past/Present Earth:</b> Describe how rapid processes (landslides, volcanic eruptions, earthquakes) change Earth's surface <b>5.4.4.a</b>			<b>Past/Present Earth:</b> Recognize Earth processes we see today are similar to those that occurred in the past (uniformity of processes) <b>8.4.4.a</b>		<b>Past/Present Earth:</b> Recognize in any sequence of sediments or rocks that has not been overturned, the youngest sediments or rocks are at the top of the sequence and the oldest are at the bottom (law of superposition) <b>12.4.4.a</b>
									<b>Past/Present Earth:</b> Describe how environmental conditions have changed through use of the fossil record <b>8.4.4.b</b>		<b>Past/Present Earth:</b> Interpret Earth's history by observing rock sequences, using fossils to correlate the sequences at various locations, and using data from radioactive dating methods <b>12.4.4.b</b>
											<b>Past/Present Earth:</b> Compare and contrast the physical and biological differences of early Earth with the planet we live on today <b>12.4.4.c</b>

**APPENDIX**

## Examples of Mathematics that Students Should Use and Understand

<b>GRADES K-4</b>	<b>GRADES 5-8</b>	<b>GRADES 9-12</b>
Measure, collect, and organize data	Represent situations verbally, numerically, graphically, geometrically, or symbolically	Develop ability to use realistic applications and modeling in trigonometry
Explore chance		
Recognize and describe patterns	Use Estimations	Understand connections within a problem situation, its model as a function in symbolic form, and the graph of that function
Use variables to express relationship	Identify and use functional relationships	
Develop skills of estimation and judgment	Develop and use tables, graphs, and rules to describe situations	Use functions that are constructed as models of real-world problems
	Use statistical methods to describe, analyze, evaluate, and make decisions	Know how to use statistics and probability
	Use geometry in solving problems	
	Create experimental and theoretical models of situations involving probabilities	

*Source: NCTM, 1989*