	Strand	Substrand	Standard Understand that...	Code	Benchmark
K	1. The Nature of Science and Engineering	1. The Practice of Science	2. Scientific inquiry is a set of interrelated processes used to pose questions about the natural world and investigate phenomena.	0.1.1.2.1	Use observations to develop an accurate description of a natural phenomenon and compare one's observations and descriptions with those of others.
		2. The Practice of Engineering	1. Some objects occur in nature; others have been designed and processed by people.	0.1.2.1.1	Sort objects into two groups: those that are found in nature and those that are human made. *For example:* Cars, pencils, trees, rocks.
	2. Physical Science	1. Matter	1. Objects can be described in terms of the materials they are made of and their physical properties.	0.2.1.1.1	Sort objects in terms of color, size, shape, and texture, and communicate reasoning for the sorting system.
	3. Earth and Space Science	2. Interdepen-dence Within the Earth System	2. Weather can be described in measurable quantities and changes from day to day and with the seasons.	0.3.2.2.1	Monitor daily and seasonal changes in weather and summarize the changes. *For example:* Recording cloudiness, rain, snow and temperature.
				0.3.2.2.2	Identify the sun as a source of heat and light. *For example:* Record the time of day when the sun shines into different locations of the school and note patterns.
	4. Life Science	1. Structure and Function in Living Systems	1. Living things are diverse with many different observable characteristics.	0.4.1.1.1	Observe and compare plants and animals.
				0.4.1.1.2	Identify the external parts of a variety of plants and animals including humans. *For example:* Heads, legs, eyes and ears on humans and animals; flowers, stems and roots on many plants.
				0.4.1.1.3	Differentiate between living and nonliving things. *For example:* Sort organisms and objects (or pictures of these) into groups of those that grow, reproduce, and need air, food, and water; and those that don't.
		2. Interdepen-dence Among Living Systems	1. Natural systems have many components that interact to maintain the system.	0.4.2.1.1	Observe a natural system or its model, and identify living and nonliving components in that system. *For example:* A wetland, prairie, garden or aquarium.

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1	1. The Nature of Science and Engineering	1. The Practice of Science	1. Scientists work as individuals and in groups to investigate the natural world, emphasizing evidence and communicating with others.	1.1.1.1.1	When asked "How do you know?," students support their answer with observations. *For example:* Use observations to tell why a squirrel is a living thing.
				1.1.1.1.2	Recognize that describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.
		3. Interactions Among Science, Technology Engineering, Mathematics, and Society	1. Designed and natural systems exist in the world. These systems are made up of components that act within a system and interact with other systems.	1.1.3.1.1	Observe that many living and nonliving things are made of parts and that if a part is missing or broken, they may not function properly.
			2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	1.1.3.2.1	Recognize that tools are used by people, including scientists and engineers, to gather information and solve problems. *For example:* Magnifier, snowplow and calculator.
	3. Earth and Space Science	1. Earth Structure and Processes	3. Earth materials include solid rocks, sand, soil and water. These materials have different observable physical properties that make them useful.	1.3.1.3.1	Group or classify rocks in terms of color, shape and size.
				1.3.1.3.2	Describe similarities and differences between soil and rocks. *For example:* Use screens to separate components of soil and observe the samples using a magnifier.
				1.3.1.3.3	Identify and describe large and small objects made of Earth materials.

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1	4. Life Science	1. Structure and Function in Living Systems	1. Living things are diverse with many different observable characteristics.	1.4.1.1.1	Describe and sort animals into groups in many ways, according to their physical characteristics and behaviors.
		2. Interdepen-dence Among Living Systems	1. Natural systems have many components that interact to maintain the system.	1.4.2.1.1	Recognize that animals need space, water, food, shelter and air.
				1.4.2.1.2	Describe ways in which an animal's habitat provides for its basic needs. *For example:* Compare students' houses with animal habitats.
		3. Evolution in Living Systems	1. Plants and animals undergo a series of orderly changes during their life cycles.	1.4.3.1.1	Demonstrate an understanding that animals pass through life cycles that include a beginning, development into adults, reproduction and eventually death. *For example:* Use live organisms or pictures to observe the changes that occur during the life cycle of butterflies, meal worms or frogs.
				1.4.3.1.2	Recognize that animals pass through the same life cycle stages as their parents.

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2	1. The Nature of Science and Engineering	1. The Practice of Science	2. Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.	2.1.1.2.1	Raise questions about the natural world and seek answers by making careful observations, noting what happens when you interact with an object, and sharing the answers with others.

2	1. The Nature of Science and Engineering	2. The Practice of Engineering	2. Engineering design is the process of identifying a problem and devising a product or process to solve the problem.	2.1.2.2.1	Identify a need or problem and construct an object that helps to meet the need or solve the problem. *For example:* Design and build a tool to show wind direction. *Another example:* Design a kite and identify the materials to use.
				2.1.2.2.2	Describe why some materials are better than others for making a particular object and how materials that are better in some ways may be worse in other ways. *For example:* Objects made of plastic or glass.
				2.1.2.2.3	Explain how engineered or designed items from everyday life benefit people.
	2. Physical Science	1. Matter	1. Objects can be described in terms of the materials they are made of and their physical properties.	2.2.1.1.1	Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object.
			2. The physical properties of materials can be changed, but not all materials respond the same way to what is done to them.	2.2.1.2.1	Observe, record and recognize that water can be a solid or a liquid and can change from one state to another.
		2. Motion	1. The motion of an object can be described by a change in its position over time.	2.2.2.1.1	Describe an object's change in position relative to other objects or a background. *For example:* Forward, backward, going up, going down.

	Strand	Substrand	Standard Understand that...	Code	Benchmark
				2.2.2.1.2	Demonstrate that objects move in a variety of ways, including a straight line, a curve, a circle, back and forth, and at different speeds. *For example:* Spinning toy and rocking toy. *Another example:* Construct objects that will move in a straight line or a curve such as a marble or toy car on a track.

	Strand	Substrand	Standard Understand that...	Code	Benchmark
2	2. Physical Science	2. Motion	2. The motion of an object can be changed by push or pull forces.	2.2.2.2.1	Describe how push and pull forces can make objects move. *For example:* Push and pull objects on smooth and rough surfaces.
				2.2.2.2.2	Describe how things near Earth fall to the ground unless something holds them up.
	3. Earth and Space Science	2. Interdepen-dence Within the Earth System	2. Weather can be described in measurable quantities and changes from day to day and with the seasons.	2.3.2.2.1	Measure, record and describe weather conditions using common tools. *For example:* Temperature, precipitation, sunrise/sunset, and wind speed/direction.
	4. Life Science	1. Structure and Function in Living Systems	1. Living things are diverse with many different observable characteristics.	2.4.1.1.1	Describe and sort plants into groups in many ways, according to their physical characteristics and behaviors.
		2. Interdepen-dence Among Living Systems	1. Natural systems have many components that interact to maintain the system	2.4.2.1.1	Recognize that plants need space, water, nutrients and air, and that they fulfill these needs in different ways.
		3. Evolution in Living Systems	1. Plants and animals undergo a series of orderly changes during their life cycles.	2.4.3.1.1	Describe the characteristics of plants at different stages of their life cycles. *For example*: Use live organisms or pictures to observe the changes that occur during the life cycles of bean plants or marigolds.

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3	1. The Nature of Science and Engineering	1. The Practice of Science	1. Scientists work as individuals and in groups, emphasizing evidence, open communication and skepticism.	3.1.1.1.1	Provide evidence to support claims other than saying “Everyone knows that,” or “I just know,” and question such reasons when given by others.

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3	1. The Nature of Science and Engineering	1. The Practice of Science	2. Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.	3.1.1.2.1	Generate questions that can be answered when scientific knowledge is combined with knowledge gained from one's own observations or investigations. *For example:* Investigate the sounds produced by striking various objects.
				3.1.1.2.2	Recognize that when a science investigation is done the way it was done before, even in a different place, a similar result is expected.
				3.1.1.2.3	Maintain a record of observations, procedures and explanations, being careful to distinguish between actual observations and ideas about what was observed. *For example:* Make a chart comparing observations about the structures of plants and animals.
				3.1.1.2.4	Construct reasonable explanations based on evidence collected from observations or experiments.
		3. Interactions Among Science, Technology Engineering, Mathematics, and Society	2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	3.1.3.2.1	Understand that everybody can use evidence to learn about the natural world, identify patterns in nature, and develop tools. *For example:* Ojibwe and Dakota knowledge and use of patterns in the stars to predict and plan.
				3.1.3.2.2	Recognize that the practice of science and/or engineering involves many different kinds of work and engages men and women of all ages and backgrounds.
			4. Tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish.	3.1.3.4.1	Use tools, including rulers, thermometers, magnifiers and simple balances, to improve observations and keep a record of the observations made.

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3	2. Physical Science	3. Energy	1. Energy appears in different forms, including sound and light.	3.2.3.1.1	Explain the relationship between the pitch of a sound, the rate of vibration of the source and factors that affect pitch. *For example:* Changing the length of a string that is plucked changes the pitch.
				3.2.3.1.2	Explain how shadows form and can change in various ways.
				3.2.3.1.3	Describe how light travels in a straight line until it is absorbed, redirected, reflected or allowed to pass through an object. *For example:* Use a flashlight, mirrors and water to demonstrate reflection and bending of light.
	3. Earth and Space Science	3. The Universe	1. The sun and moon have locations and movements that can be observed and described.	3.3.3.1.1	Observe and describe the daily and seasonal changes in the position of the sun and compare observations.
				3.3.3.1.2	Recognize the pattern of apparent changes in the moon's shape and position.
			2. Objects in the solar system as seen from Earth have various sizes and distinctive patterns of motion.	3.3.3.2.1	Demonstrate how a large light source at a great distance looks like a small light that is much closer. *For example:* Car headlights at a distance look small compared to when they are close.
				3.3.3.2.2	Recognize that the Earth is one of several planets that orbit the sun, and that the moon orbits the Earth.
	4. Life Science	1. Structure and Function in Living Systems	1. Living things are diverse with many different characteristics that enable them to grow, reproduce and survive.	3.4.1.1.1	Compare how the different structures of plants and animals serve various functions of growth, survival and reproduction. *For example:* Skeletons in animals and stems in plants provide strength and stability.
				3.4.1.1.2	Identify common groups of plants and animals using observable physical characteristics, structures and behaviors. *For example:* Sort animals into groups such as mammals and amphibians based on physical characteristics. *Another example:* Sort and identify common Minnesota trees based on leaf/needle characteristics.

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3	4. Life Science	3. Evolution in Living Systems	2. Offspring are generally similar to their parents, but may have variations that can be advantageous or disadvantageous in a particular environment.	3.4.3.2.1	Give examples of likenesses between adults and offspring in plants and animals that can be inherited or acquired. *For example:* Collect samples or pictures that show similarities between adults and their young offspring.
				3.4.3.2.2	Give examples of differences among individuals that can sometimes give an individual an advantage in survival and reproduction.

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4	1. The Nature of Science and Engineering	2. The Practice of Engineering	1. Engineers design, create and develop structures, processes and systems that are intended to improve society and may make humans more productive.	4.1.2.1.1	Describe the positive and negative impacts that the designed world has on the natural world as more and more engineered products and services are created and used.
			2. Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product.	4.1.2.2.1	Identify and investigate a design solution and describe how it was used to solve an everyday problem. *For example:* Investigate different varieties of construction tools.
				4.1.2.2.2	Generate ideas and possible constraints for solving a problem through engineering design. *For example:* Design and build an electromagnet to sort steel and aluminum materials for recycling.
				4.1.2.2.3	Test and evaluate solutions, considering advantages and disadvantages of the engineering solution, and communicate the results effectively.
		3. Interactions Among Science, Technology Engineering, Mathematics, and Society	3. The needs of any society influence the technologies that are developed and how they are used.	4.1.3.3.1	Describe a situation in which one invention led to other inventions.
	2. Physical Science	1. Matter	1. Objects have observable properties that can be measured.	4.2.1.1.1	Measure temperature, volume, weight and length using appropriate tools and units.

4	2. Physical Science	1. Matter	2. Solids, liquids and gases are states of matter that have unique properties.	4.2.1.2.1	Distinguish between solids, liquids and gases in terms of shape and volume. *For example:* Liquid water changes shape depending on the shape of its container.
				4.2.1.2.2	Describe how the states of matter change as a result of heating and cooling.

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		3. Energy	1. Energy appears in different forms, including heat and electromagnetism.	4.2.3.1.1	Describe the transfer of heat energy when a warm and a cool object are touching or placed near each other.
				4.2.3.1.2	Describe how magnets can repel or attract each other and how they attract certain metal objects.
				4.2.3.1.3	Compare materials that are conductors and insulators of heat and/or electricity. *For example:* Glass conducts heat well, but is a poor conductor of electricity.
			2. Energy can be transformed within a system or transferred to other systems or the environment.	4.2.3.2.1	Identify several ways to generate heat energy. *For example:* Burning a substance, rubbing hands together, or electricity flowing through wires.
				4.2.3.2.2	Construct a simple electrical circuit using wires, batteries and light bulbs.
				4.2.3.2.3	Demonstrate how an electric current can produce a magnetic force. *For example:* Construct an electromagnet to pick up paperclips.
	3. Earth and Space Science	1. Earth Structure and Processes	3. Rocks are Earth materials that may vary in composition.	4.3.1.3.1	Recognize that rocks may be uniform or made of mixtures of different minerals.
				4.3.1.3.2	Describe and classify minerals based on their physical properties. *For example:* Streak, luster, hardness, reaction to vinegar.
		2. Interdepen-dence Within the Earth System	3. Water circulates through the Earth's crust, oceans and atmosphere in what is known as the water cycle.	4.3.2.3.1	Identify where water collects on Earth, including atmosphere, ground and surface water, and describe how water moves through the Earth system using the processes of evaporation, condensation and precipitation.
		4. Human Interactions with Earth Systems	1. In order to improve their existence, humans interact with and influence Earth systems.	4.3.4.1.1	Describe how the methods people utilize to obtain and use water in their homes and communities can affect water supply and quality.
4	4. Life Science	4. Human Interactions with Living Systems	2. Microorganisms can get inside one's body and they may keep it from working properly.	4.4.4.2.1	Recognize that the body has defense systems against germs, including tears, saliva, skin and blood.
				4.4.4.2.2	Give examples of diseases that can be prevented by vaccination.

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5	1. The Nature of Science and Engineering	1. The Practice of Science	1. Science is a way of knowing about the natural world, is done by individuals and groups, and is characterized by empirical criteria, logical argument and skeptical review.	5.1.1.1.1	Explain why evidence, clear communication, accurate record keeping, replication by others, and openness to scrutiny are essential parts of doing science.
				5.1.1.1.2	Recognize that when scientific investigations are replicated they generally produce the same results, and when results differ significantly, it is important to investigate what may have caused such differences. *For example:* Measurement errors, equipment failures, or uncontrolled variables.
				5.1.1.1.3	Understand that different explanations for the same observations usually lead to making more observations and trying to resolve the differences.
				5.1.1.1.4	Understand that different models can be used to represent natural phenomena and these models have limitations about what they can explain. *For example:* Different kinds of maps of a region provide different information about the land surface.
			2. Scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.	5.1.1.2.1	Generate a scientific question and plan an appropriate scientific investigation, such as systematic observations, field studies, open-ended exploration or controlled experiments to answer the question.
				5.1.1.2.2	Identify and collect relevant evidence, make systematic observations and accurate measurements, and identify variables in a scientific investigation.
				5.1.1.2.3	Conduct or critique an experiment, noting when the experiment might not be fair because some of the things that might change the outcome are not kept the same, or that the experiment is not repeated enough times to provide valid results.

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5	1. Nature of Science and Engineering	3. Interactions Among Science, Technology Engineering, Mathematics, and Society	2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	5.1.3.2.1	Describe how science and engineering influence and are influenced by local traditions and beliefs. *For example:* Sustainable agriculture practices used by many cultures.
			4. Tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish.	5.1.3.4.1	Use appropriate tools and techniques in gathering, analyzing and interpreting data. *For example:* Spring scale, metric measurements, tables, mean/median/range, spreadsheets, and appropriate graphs.
				5.1.3.4.2	Create and analyze different kinds of maps of the student's community and of Minnesota. *For example:* Weather maps, city maps, aerial photos, regional maps or online map resources.
	2. Physical Science	2. Motion	1. An object's motion is affected by forces and can be described by the object's speed and the direction it is moving.	5.2.2.1.1	Give examples of simple machines and demonstrate how they change the input and output of forces and motion.
				5.2.2.1.2	Identify the force that starts something moving or changes its speed or direction of motion. *For example:* Friction slows down a moving skateboard.
				5.2.2.1.3	Demonstrate that a greater force on an object can produce a greater change in motion.
	3. Earth and Space Science	1. Earth Structure and Processes	2. The surface of the Earth changes. Some changes are due to slow processes and some changes are due to rapid processes.	5.3.1.2.1	Explain how, over time, rocks weather and combine with organic matter to form soil.
				5.3.1.2.2	Explain how slow processes, such as water erosion, and rapid processes, such as landslides and volcanic eruptions, form features of the Earth's surface.

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5	3. Earth and Space Science	4. Human Interactions with Earth Systems	1. In order to maintain and improve their existence, humans interact with and influence Earth systems.	5.3.4.1.1	Identify renewable and non-renewable energy and material resources that are found in Minnesota and describe how they are used. *For example:* Water, iron ore, granite, sand and gravel, wind and forests.
				5.3.4.1.2	Give examples of how mineral and energy resources are obtained and processed and how that processing modifies their properties to make them more useful. *For example:* Iron ore, biofuels, or coal.
				5.3.4.1.3	Compare the impact of individual decisions on natural systems. *For example:* Choosing paper or plastic bags impacts landfills as well as ocean life cycles.
	4. Life Science	1. Structure and Function in Living Systems	1. Living things are diverse with many different characteristics that enable them to grow, reproduce and survive.	5.4.1.1.1	Describe how plant and animal structures and their functions provide an advantage for survival in a given natural system. *For example:* Compare the physical characteristics of plants or animals from widely different environments, such as desert versus tropical, and explore how each has adapted to its environment.
		2. Interdepen-dence Among Living Systems	1. Natural systems have many components that interact to maintain the living system.	5.4.2.1.1	Describe a natural system in Minnesota, such as a wetland, prairie or garden, in terms of the relationships among its living and nonliving parts, as well as inputs and outputs. *For example:* Design and construct a habitat for a living organism that meets its need for food, air and water.
				5.4.2.1.2	Explain what would happen to a system such as a wetland, prairie or garden if one of its parts were changed. *For example:* Investigate how road salt runoff affects plants, insects and other parts of an ecosystem. *Another example:* Investigate how an invasive species changes an ecosystem.
		4. Human Interactions with Living Systems	1. Humans change environments in ways that can be either beneficial or harmful to themselves and	5.4.4.1.1	Give examples of beneficial and harmful human interaction with natural systems. *For example:* Recreation, pollution, or wildlife management.

	Strand	Substrand	Standard Understand that...	Code	Benchmark
			other organisms.		

	Strand	Substrand	Standard Understand that...	Code	Benchmark
6	1. The Nature of Science and Engineering	2. The Practice of Engineering	1. Engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	6.1.2.1.1	Identify a common engineered system and evaluate its impact on the daily life of humans. *For example:* Refrigeration, cell phone or automobile.
				6.1.2.1.2	Recognize that there is no perfect design and that new technologies have consequences that may increase some risks and decrease others. *For example:* Seat belts and airbags.
				6.1.2.1.3	Describe the trade-offs in using manufactured products in terms of features, performance, durability and cost.
				6.1.2.1.4	Explain the importance of learning from past failures, in order to inform future designs of similar products or systems. *For example:* Space shuttle or bridge design.
			2. Engineering design is the process of devising products, processes and systems that address a need, capitalize on an opportunity, or solve a specific problem.	6.1.2.2.1	Apply and document an engineering design process that includes identifying criteria and constraints, making representations, testing and evaluation, and refining the design as needed to construct a product or system that solves a problem. *For example:* Investigate how energy changes from one form to another by designing and constructing a simple roller coaster for a marble.
		3. Interactions Among Science, Technology, Engineering, Mathematics and Society	1. Designed and natural systems exist in the world. These systems consist of components that act within the system and interact with other systems.	6.1.3.1.1	Describe a system in terms of its subsystems and parts, as well as its inputs, processes and outputs.
				6.1.3.1.2	Distinguish between open and closed systems. *For example:* Compare mass before and after a chemical reaction that releases a gas in sealed and open plastic bags.

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6	1. The Nature of Science and Engineering	3. Interactions Among Science, Technology, Engineering, Mathematics and Society	4. Current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.	6.1.3.4.1	Determine and use appropriate safe procedures, tools, measurements, graphs and mathematical analyses to describe and investigate natural and designed systems in a physical science context.
				6.1.3.4.2	Demonstrate the conversion of units within the International System of Units (SI, or metric) and estimate the magnitude of common objects and quantities using metric units.
	2. Physical Science	1. Matter	1. Pure substances can be identified by properties which are independent of the sample of the substance and the properties can be explained by a model of matter that is composed of small particles.	6.2.1.1.1	Explain density, dissolving, compression, diffusion and thermal expansion using the particle model of matter.
			2. Substances can undergo physical changes which do not change the composition or the total mass of the substance in a closed system.	6.2.1.2.1	Identify evidence of physical changes, including changing phase or shape, and dissolving in other materials.
				6.2.1.2.2	Describe how mass is conserved during a physical change in a closed system. *For example:* The mass of an ice cube does not change when it melts.
				6.2.1.2.3	Use the relationship between heat and the motion and arrangement of particles in solids, liquids and gases to explain melting, freezing, condensation and evaporation.
		2. Motion	1. The motion of an object can be described in terms of speed, direction and change of position.	6.2.2.1.1	Measure and calculate the speed of an object that is traveling in a straight line.
				6.2.2.1.2	For an object traveling in a straight line, graph the object's position as a function of time, and its speed as a function of time. Explain how these graphs describe the object's motion.

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6	2. Physical Science	2. Motion	2. Forces have magnitude and direction and affect the motion of objects.	6.2.2.2.1	Recognize that when the forces acting on an object are balanced, the object remains at rest or continues to move at a constant speed in a straight line, and that unbalanced forces cause a change in the speed or direction of the motion of an object.
				6.2.2.2.2	Identify the forces acting on an object and describe how the sum of the forces affects the motion of the object. *For example:* Forces acting on a book on a table or a car on the road.
				6.2.2.2.3	Recognize that some forces between objects act when the objects are in direct contact and others, such as magnetic, electrical and gravitational forces can act from a distance.
				6.2.2.2.4	Distinguish between mass and weight.
		3. Energy	1. Waves involve the transfer of energy without the transfer of matter.	6.2.3.1.1	Describe properties of waves, including speed, wavelength, frequency and amplitude.
				6.2.3.1.2	Explain how the vibration of particles in air and other materials results in the transfer of energy through sound waves.
				6.2.3.1.3	Use wave properties of light to explain reflection, refraction and the color spectrum.
			2. Energy can be transformed within a system or transferred to other systems or the environment.	6.2.3.2.1	Differentiate between kinetic and potential energy and analyze situations where kinetic energy is converted to potential energy and vice versa.
				6.2.3.2.2	Trace the changes of energy forms, including thermal, electrical, chemical, mechanical or others as energy is used in devices. *For example:* A bicycle, light bulb or automobile.
				6.2.3.2.3	Describe how heat energy is transferred in conduction, convection and radiation.