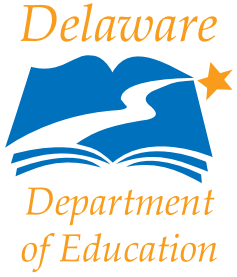

Science Standard 1
Nature and Application of Science and Technology
Grade Level Expectations

Science Standard 1
Nature and Application of Science and Technology

Science is a human endeavor involving knowledge learned through inquiring about the natural world. Scientific claims are evaluated and knowledge changes as a result of using the abilities and understandings of inquiry. The pursuit of scientific knowledge is a continuous process involving diverse people throughout history. The practice of science and the development of technology are critical pursuits of our society.

Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
Understandings and Abilities of Scientific Inquiry Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation. Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence? Why is it necessary to justify and communicate an explanation?	1. Understand that: Scientific investigations, whether conducted by students or scientists, involve asking a question about the natural world. Be able to: Generate questions and predictions using observations and exploration about the natural world. 2. Understand that: In a science investigation, a fair test is one in which all of the conditions are kept constant except the one condition being investigated. Be able to: Generate and follow simple plans using systematic observations to explore questions and predictions. 3. Understand that: The purpose of accurate observations and data collection is to provide evidence. Scientists use tools to enhance their senses in order to obtain more evidence. Be able to: Collect data using observations, simple tools and equipment. Record data in tables, charts, and bar graphs. Compare data with others to examine and question results.	1. Understand that: Scientific investigations involve asking a focused scientific question. Investigations differ depending upon the question being asked. Be able to: Generate focused questions and informed predictions about the natural world. 2. Understand that: Fair test design supports the validity of the investigation. Sometimes it is not possible to know everything that will have an effect on the investigation or control all conditions. Be able to: Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested. 3. Understand that: The purpose of accurate data collection is to provide evidence to compare with the prediction. Be able to: Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and	1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation. Be able to: Frame and refine questions that can be investigated scientifically, and generate testable hypotheses. 2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question. Be able to: Design and conduct investigations with controlled variables to test hypotheses. 3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment. Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation.	1. Understand that: Scientists conduct investigations for a variety of reasons including to explore new phenomena, to replicate other's results, to test how well a theory predicts, to develop new products, and to compare theories. Be able to: Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation. 2. Understand that: Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments and healthy skepticism. Be able to: Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis. 3. Understand that: Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses. The application of theories allows people to make reasonable

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Understandings and Abilities of Scientific Inquiry continued from previous page	4. Understand that: Scientists use observations from investigations and knowledge that is already known to develop an explanation. Be able to: Construct a simple explanation by analyzing observational data. Revise the explanation when given new evidence or information gained from other resources or from further investigation. 5. Understand that: The purpose of communicating with others is to share evidence and conclusions. Scientists communicate the results of their investigations to others. Be able to: Share simple plans, data, and explanations with an audience and justify the results using the evidence from the investigation. 6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries.	question results with and from others. 4. Understand that: The body of scientific knowledge grows as scientists ask questions, conduct investigations, develop explanations and compare results with what is already known. Be able to: Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation. 5. Understand that: The purpose of communicating is to share and justify results. Scientists communicate their results to others, including the details that allow others to replicate the results. Be able to: Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument.	Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students. 4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge. Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation. 5. Understand that: Evaluating the explanations proposed by others involves examining and	predictions. Theories may be amended to become more complete with the introduction of new evidence. Be able to: Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results. 4. Understand that: Investigating most real-world problems requires building upon previous scientific findings and cooperation among individuals with knowledge and expertise from a variety of scientific fields. The results of scientific studies are considered valid when subjected to critical review where contradictions are resolved and the explanation is confirmed.

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Understandings and Abilities of Scientific Inquiry continued from previous page	Be able to: Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results.	6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries. Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.	comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and resolution of the conflict. Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results. 6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.	Be able to: Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence. 5. Understand that: In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. (American Association for the Advancement of Science, 2001) Be able to: Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information. 6. Understand that: Knowledge and skill from sources other than science are essential to scientific inquiry. These include mathematics, reading, writing, and technology.

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Understandings and Abilities of Scientific Inquiry continued from previous page			Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.	Be able to: Use mathematics, reading, writing and technology when conducting scientific inquiries.
Science, Technology, and Society Enduring Understanding: The development of technology and advancement in science influence and drive each other forward. Essential Question: How do science and technology influence each other?	1. People have invented new technologies to solve problems. 2. Tools are useful in science to help gather data for observations and measurements and provide a safe means of conducting an investigation.	1. Science and technology are related. Technology provides the tools needed for science to investigate questions and may provide solutions to society's problems, wants, or needs. Not all technological solutions are effective, uniformly beneficial, or equally available to everyone.	1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered. 2. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.	1. The pursuit of science can generate the need for advanced technology. Advanced technology, in turn, can provide the opportunity to pursue new scientific knowledge. 2. The social, economic, and political forces of a society have a significant influence on what science and technology programs are pursued, funded, and implemented.

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History and Context of Science Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge. Essential Question: How have past scientific contributions influenced current scientific understanding of the world? What do we mean in science when we say that we stand on the shoulders of giants?	1. People from all parts of the world practice science and make many important scientific contributions. 2. Much has been learned about the natural world but there is still much to understand.	1. Contributions by individuals have been essential in advancing the body of scientific knowledge.	1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying some of these contributions and how they came about provides insight into the expansion of scientific knowledge.	1. New disciplines of science emerge as older disciplines interface into an integrated study of the natural world. As the body of scientific knowledge grows, the boundaries between individual disciplines diminish.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades K-3

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Generate and follow simple plans using systematic observations to explore questions and predictions.	Generate and follow simple plans using systematic observations to explore questions and predictions.	Generate and follow simple plans using systematic observations to explore questions and predictions.	Generate and follow simple plans using systematic observations to explore questions and predictions.
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Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results. ***Also in Standard 2:*** Observe and describe the properties of a variety of non-living materials using the senses (i.e., sight, touch, smell, hearing). Use the physical properties of non-living materials (e.g., texture, size, shape, color) to describe similarities and differences. Sort, group, and regroup a variety of familiar non-living materials based on their physical properties (e.g., shape, color, texture, size). Use a hand lens (magnifier) to inspect a variety of non-living materials and demonstrate through discussion or drawings how the lens extends the sense of sight. Construct simple class graphs (e.g., pictographs, physical graphs) to organize information.	Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results. ***Also in Standard 2:*** Conduct simple investigations to identify the physical properties (e.g., ability to sink or float, dissolve in water, roll or stack) of solids and liquids. Record the results on charts, diagrams, graphs, and/or drawings. Sort and group solids based on physical properties such as color, shape, ability to roll or stack, hardness, magnetic attraction, or whether they sink or float in water. Compare and describe similarities and differences in physical properties of various solid objects. Sort and group liquids based on physical properties such as color, odor, tendency to flow, and whether they sink, or float. Compare and describe similarities and differences in physical properties of various liquids.	Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results. ***Also in Standard 2:*** Use an equal arm balance to weigh and compare a variety of objects and recognize that weighing is the process of balancing an object against a certain number of standard units. Predict the serial order for the weights of a variety of objects and test these predictions by weighing the objects. ***Also in Standard 3:*** Identify that objects that move have energy because of their motion. Demonstrate that a hanging mobile has energy because of its motion and the mobile was given this energy by the push of moving air. Investigate how to change an object's movement by giving it a push or pull. Demonstrate that the greater the force, the greater the change in motion of the object. Summarize this understanding through the use of visuals or writing.	Use mathematics, reading, writing, and technology when conducting an investigation and communicating the results. ***Also in Standard 2:*** Observe and describe changes in the properties of water as it changes from solid to liquid to gas. ***Also in Standard 3:*** Determine the effect of adding heat energy (warming) or removing heat energy (cooling) on the properties of water as it changes state (gas to liquid to solid, and vice versa). Investigate and describe what happens when an object at a higher temperature is placed in direct contact with an object at a lower temperature. Record data and use the data to describe which way the heat energy is moving between the objects. Demonstrate that energy of motion can be transferred from one object to another (e.g., moving air transfers energy to make a pinwheel spin). Give examples of energy transfer from one object to another.

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Interpret and describe the simple graphs constructed by the class. Use non-standard units of measure (e.g., string, paper clips) to compare the size and weight of non-living materials. Observe and describe changes in the physical properties of objects that occur when they are exposed to a variety of treatments (i.e., temperature, sunlight, water). ***Also in Standard 3:*** Demonstrate that the position of an object can be above or below, in front of or behind, or to the left or right of another object. Observe that objects move in different ways such as fast, slow, sideways, zigzag and swaying back and forth. Observe how the air makes the trees and other objects move. Describe how a fast moving wind can make objects move more than a gentle breeze (i.e., trees swaying).	Construct individual and class diagrams (e.g., Venn, pictographs) to compare the similarities and differences between the properties of solids and liquids. Observe and describe changes in the physical properties of solids and liquids after exposure to various treatments (i.e., temperature, sunlight, water). Use writing, drawing, and discussion to communicate observations, descriptions, investigations, and experiences concerning solids and liquids. ***Also in Standard 3:*** Observe that heat energy makes things warmer. Observe the evidence of the force of air pushing on objects and materials such as pinwheels and kites. Compare how the direction and speed (fast, slow) of the moving air affects the motion of the objects. Observe and measure the temperature of hot and cold water. Investigate what happens when hot and cold water are mixed. Record data on a graph and use the data to summarize the results.	Demonstrate that when the pushes and pulls acting on an object are balanced, the object will not move. Investigate the conditions necessary for objects to balance. Describe how the object was made to balance. ***Also in Standard 5:*** Observe and identify basic components of soil. Use the senses to observe and then describe the physical properties of soil components. Conduct simple tests to identify the three basic components of soil (sand, clay, humus) and to compare and contrast the properties of each of the components. Interpret test results (touch and roll, smear, settling, ability to absorb and retain water) and draw conclusions about a soil's components. Record and organize the results of soil tests and explain these results through writing, drawing, and discussion. Reflect on the test results and predict how plants will grow in different soil components.	Simulate how bones, muscles and joints in the human body work to transfer energy to objects, making them move. ***Also in Standard 5:*** Examine rocks in order to observe their composition and describe the many components found in rocks. Sort and group an assortment of minerals based on similarities and differences in their physical properties. Sort and group minerals based on the physical properties of hardness, color, luster, and reaction to vinegar (weak acid). Use these properties to identify common minerals (quartz, fluorite, calcite, and gypsum). Describe water in terms of its observable properties (transparency, shapelessness, flow). Examine an assortment of rocks and use appropriate measuring tools (balances, meter tapes, syringes) to gather data about the rocks' physical properties (length, circumference, weight).

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Also in Standard 4: Name and identify objects that can be observed in the sky including the Sun, Moon, and stars and man-made objects such as airplanes. ***Also in Standard 5:*** Observe and describe the properties of a variety of earth materials (i.e., rock, soil, sand, water) using the senses. Sort, group, and regroup a variety of earth materials based on their physical properties (e.g., shape, color, texture, size, etc.) to describe their similarities and differences. Use a hand lens (magnifier) to inspect a variety of earth materials and demonstrate through discussion or drawings how the lens extends the sense of sight. ***Also in Standard 6:*** Observe and describe the properties of a variety of living and non-living things using the five senses. Use the physical properties of living and non-living things to describe their similarities and differences.	Investigate what happens to the temperature of an object when it is placed in direct sunlight. Record data and conclude that the energy in the sunlight was changed into heat energy in the object. Compare what happens when sunlight strikes dark and light colored objects. Draw conclusions that dark colored objects feel warmer and increase more in temperature in sunlight than do light colored objects. ***Also in Standard 4:*** List objects that can be observed in the sky in the daytime and objects that can be observed in the sky at nighttime. Discuss which objects are on which lists (e.g., the Moon can be observed sometimes in the day and sometimes at night). Safely observe the location of the Sun at the same time in the morning, noon, and afternoon over several days. Describe the Sun's movement across the sky over the course of the day. Observe the Moon in the day sky over several months. Draw a sequence of pictures that shows the repeating cyclic	Apply this knowledge to describe how the properties of each soil component contribute to an appropriate soil mixture in growing plants. ***Also in Standard 6:*** Identify and describe the structures of insects and various other organisms that enable them to function in their environment. Compare and contrast the structures on different kinds of insects at different stages of development. Given several pictures of adult organisms, identify and explain which organisms are insects and which are not. Observe common structures of different insects (e.g., mouth parts or legs). Describe the similarities and differences among the structures. Recognize that the structure is related to the function it performs (e.g., a caterpillar mouth for chomping leaves differs from a butterfly proboscis for obtaining nectar). Observe a variety of plants and animals. Compare specific needs that are common to plants or animals of the same group (i.e., all fish need water but some fish need	***Also in Standard 6:*** Describe how bones, muscles, and joints function together in humans to enable movement, protection and support. Identify the structures of different types of joints (gliding, hinged, ball and socket) and describe the movement enabled by each. Recognize the importance of each type of joint to human movement. Compare and contrast the structure and function of the human skeleton to that of other vertebrate animals. Conduct simple investigations to determine and describe how different body parts respond to visual, auditory, and tactile stimuli. Research and report on common diseases or problems of the muscular and skeletal systems. Explain how these systems can be affected by external factors (i.e., bones can be broken and healed, good nutrition leads to strong bones).

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Sort, group, and regroup a variety of familiar living and non-living things based on their physical properties (e.g., shape, color, texture, taste, size, etc.). Use a hand lens (magnifier) to inspect a variety of living things and demonstrate through discussion and drawings how the lens extends the sense of sight to see structures in greater detail. Use non-standard units of measure to compare the size and mass of structures of living things (e.g., string around trees, paper clips to measure length of leaves). Identify structures on plants and animals and describe how the structure functions (e.g., trees have bark for protection and rabbits have fur to keep them warm). Observe how the living things in an environment change with the seasons (e.g., trees lose their leaves in the winter).	pattern of the Moon. Use simple models to demonstrate how Earth's rotation causes day and night. ***Also in Standard 5:*** Keep daily records of weather conditions (wind speed, type and amount of precipitation, cloud cover and type, temperature) and use these records to identify patterns over short and long periods of time. Demonstrate that there is air all around and that the wind is moving air. Use instruments to qualitatively measure wind speed and describe this by using a simplified Beaufort scale. Use a thermometer to measure temperature in degrees Fahrenheit. Describe how hot or cold an object or weather event feels by using a thermometer. Identify three basic cloud types (cirrus, cumulus, stratus) all of which are made of water and/or ice. Conclude that wind moves clouds in the sky.	cold water to live and some need warm water to live, all plants need water but some need a humid environment and some need a dry environment). Conduct simple investigations to determine and describe how insects and various other organisms respond to different kinds of stimuli, (e.g., light versus dark environment). Investigate and evaluate how plant growth is affected by varying amounts of different soil components. Conduct simple investigations using artificial habitats to describe how the survival of insects is affected by the environment. ***Also in Standard 7:*** Observe the life cycle of a selected organism (e.g., plant, butterfly, frog, etc.) and recognize that the stages of the life cycle are predictable and describable. Identify the stages in a life cycle of an organism that goes through complete metamorphosis (e.g., butterfly, mealworm).	***Also in Standard 7:*** Observe and describe similarities and differences in the skeleton of an infant to that of an adult human. Recognize that as a human grows and develops the number of bones does not change but the sizes of the bones do change. Recognize that there are many different kinds of vertebrates in the world. One way to sort or group vertebrates is according to the structure and function of their skeletons (i.e., bird wings and human arms).

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Also in Standard 7: Observe and describe similarities and differences between parents and offspring (e.g., roots on a mature tree vs. roots on a seedling). Use a hand lens (magnifier) as an appropriate instrument for observing in closer detail. Construct, through the use of pictorials, the life cycle of a tree. Describe the tree in different stages of its life cycle.	Use a rain gauge to measure precipitation and describe how this measurement would change when frozen precipitation such as snow or ice melts. Organize weather data on graphs and on long-term data collection charts and use this data to describe typical seasonal weather patterns. Describe different weather conditions and discuss how these conditions affect plants, animals, and human activity. ***Also in Standard 6:*** Select the hand lens as an appropriate instrument for observing the structure of aquatic and terrestrial organisms in greater detail. Observe individuals of the same plant or animal group. Describe physical differences (e.g., size, color, shape, markings). Identify and describe structures of plants and animals that help them survive in aquatic and terrestrial environments.	Describe the similarities and differences in the structures and behaviors of the egg, larvae, pupae, and adult insect. Identify the stages in the life cycle of an organism that goes through simple (incomplete) metamorphosis (e.g., grasshopper, cricket). Describe the similarities and differences in the structures and behaviors of the egg, nymph, and adult insect. Recognize that there are many different kinds of animals in the world, of which insects are one grouping. Sort insects from animals that are not insects. Identify the characteristics used to sort the insects (i.e., three body parts, six legs). ***Also in Standard 8:*** Describe the effects that result from plants, insects and other animals changing the environment in which they live (e.g., worms make tunnels in the earth, crickets eat the grass). Observe the plants and animals living in an environment. Identify ways in which plants and animals benefit from each other (e.g., animals use plants for food	

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades K-3

Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence? Why is it necessary to justify and communicate an explanation? Essential Question: How do science and technology influence each other? Essential Questions: How have past scientific contributions influenced current scientific understanding of the world? What do we mean in science when we say that we stand on the shoulders of giants?			
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	Sort and group plants and animals based on the structures that enable them to function in their environment (e.g., animals that have fins for swimming versus animals that have legs for movement on land). Compare and contrast the observable structures of humans to those of other animals and plants. Record and communicate the similarities and differences in their structures. Observe a variety of plants and animals and identify basic needs that are common to plants or animals of the same group, such as food, water, air, shelter, space and light. Using the senses to detect environmental conditions, respond by selecting the appropriate clothing for certain weather conditions based on temperature, wind speed, cloud cover and/or precipitation. Justify the selection of clothing and activity.	and shelter, and plants need insects to spread pollen). Observe and describe the effects of plant and animal overcrowding in a given space (i.e., many guppies in an aquarium, many beetles in a habitat). Recognize that this overcrowding results in an increased need for basic resources. Investigate how natural composting recycles plants and other discarded organic matter. Recognize the importance of this process to the environment.	

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	Design terrestrial and aquatic habitats that provide healthy environments for the plant and animal inhabitants. ***Also in Standard 7:*** Recognize that organisms change over time. Record and communicate changes observed in living things over time. Construct, through the use of pictorials, the life cycle of guppies. Describe the guppy in different stages of its life cycle. Describe similarities and differences between parents and offspring, such as size and color. Recognize that there are many different kinds of plants and animals in the world. Sort terrestrial animals from aquatic animals. Identify the characteristics used to separate the terrestrial from aquatic animals. ***Also in Standard 8:*** Describe the impact weather conditions (e.g., sun, fog, rain, snow) have on plant and animal activities.		

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	Identify the number of different kinds of living things in an aquatic or terrestrial environment. Recognize that living things coexist in these environments. Describe how aquatic plants and animals interact with each other and their environment (e.g., fish use plants for food and shelter). Describe how terrestrial plants and animals interact with each other and their environment (e.g., millipedes eat decaying bark).		
Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward. ***Also in Standard 2:*** Use a hand lens (magnifier) to inspect a variety of non-living materials and demonstrate through discussion or drawings how the lens extends the sense of sight.	**Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward.** ***Also in Standard 3:*** Observe that sunlight can be used to heat the inside of homes and other buildings by allowing the sunlight to pass through windows.	**Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward.** ***Also in Standard 5:*** Select and use appropriate instruments (e.g., hand lens/magnifier, droppers, funnels, filter paper, sieves) to analyze soil samples.	**Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward.** ***Also in Standard 3:*** Investigate and describe how moving water and air can be used to make objects and machines, such as a waterwheel and windmill, move.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades K-3

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Observe how materials can be modified for different uses (e.g., paper and wood can be modified to have new properties). ***Also in Standard 4:*** Describe how binoculars help our sense of sight by allowing us to magnify objects in the sky. ***Also in Standard 6:*** Describe how the senses can be protected when conducting scientific investigations (e.g., goggles protect eyes, gloves protect hands). **Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*	***Also in Standard 5:*** Select and use appropriate instruments such as wind scales, thermometers, cloud charts, and rain gauges to measure weather conditions. **Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.** ***Also in Standard 5:*** Identify a meteorologist as a scientist who uses technology to study, observe, and record information about the weather and who uses this information to forecast the weather. Use weather forecasts to make decisions such as choice of clothing or outdoor activities.	***Also in Standard 7:*** Recognize that some insects are considered harmful to humans, plants, and other animals while other insects can be beneficial. Technology allows us to help control the harmful insects (i.e., control of mosquitoes, termites, ticks, etc.). **Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*	***Also in Standard 5:*** Identify rocks and minerals as natural resources and list ways that humans use these resources to meet needs and wants (i.e., fluorite for toothpaste, marble for statues). ***Also in Standard 7:*** Recognize that technology extends the sense of sight for observing bones, muscles and joints in greater detail (i.e., X-Rays). ***Also in Standard 8:*** Describe the changes to the environment that result from humans obtaining rock and mineral resources (e.g., strip mining). **Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 4-5

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Building upon the K-3 expectations, all students in **Grade 4** will be able to:	Building upon the K-4 expectations, all students in **Grade 5** will be able to:
Enduring Understandings: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation. Generate focused questions and informed predictions about the natural world. Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested. Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others. Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation. Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument. Use mathematics, reading, writing, and technology when conducting scientific inquiries. ***Also in Standard 2:*** Test objects for their conductivity and classify the objects based on whether they conduct electricity (conductors) or do not conduct electricity (insulators). Test objects for their magnetism and classify objects based on whether they are attracted to a magnet or not attracted to a magnet. Investigate evaporation and condensation. Recognize the relationship between temperature and changes of state from liquid to gas in evaporation and gas to liquid in condensation using water as an example.	**Enduring Understandings: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.** Generate focused questions and informed predictions about the natural world. Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested. Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others. Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation. Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument. Use mathematics, reading, writing, and technology when conducting scientific inquiries. ***Also in Standard 2:*** Separate the components of a mixture by using the physical properties of the components and choosing the appropriate processes (e.g., evaporation, filtering). Make and implement a plan to separate mixtures. Revise the plan based on evidence collected. Record and communicate the results. Combine different amounts of solid material and water. Compare the properties of these solutions (i.e., color, viscosity, clarity). Compare the mass of mixtures and solutions to the mass of their component parts.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 4-5

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Building upon the K-3 expectations, all students in **Grade 4** will be able to:	Building upon the K-4 expectations, all students in **Grade 5** will be able to:
Also in Standard 3: Identify the basic components (i.e., battery, wires, bulbs, switch) of an electric circuit and understand their function. Draw an example circuit and label the important parts. Relate that circuits must take the form of complete (closed) loops before electrical energy can pass. Use diagrams to illustrate ways that two light bulbs can be attached in simple series and in parallel to a battery to make a complete circuit. Explain any differences that will result in the brightness of the bulbs, depending upon the way they are connected to the battery. Test objects for their conductivity and classify the materials based on whether they conduct electricity (conductors) or do not conduct electricity (insulators). Choose which materials would be used to construct a circuit and justify your choices. Demonstrate, through writing and drawing, a variety of ways to construct open, closed, simple parallel and series circuits. List the advantages and/or disadvantages of series and parallel circuits. Observe diagrams or pictures of a variety of circuits and demonstrate how the switch can be used to open or close the circuit. Observe that electricity can be transformed into heat, light, and sound as well as the energy of motion. Explain that electrical circuits provide a means of transferring electrical energy from sources such as batteries to devices where it is transformed into heat, light, sound, and the energy of motion. ***Also in Standard 4:*** Observe and describe the path of the Sun at it appears to move across the sky from east to west during the course of a day.	Determine the quantities of two different materials (e.g., salt and sugar) required to saturate equal volumes of water and compare the results. Recognize that some materials are more soluble in water than other materials. Explain why the total amount of a material remains the same even when exposed to a variety of physical treatments (e.g., flattening or balling up clay, breaking apart a candy bar, pouring liquid into a tall, slender glass vs. a short, fat glass). ***Also in Standard 3:*** Design and implement an investigation to show that white light coming from the sun consists of a variety of component waves that appear to have different colors to our eyes. Record observations of the investigation and use evidence to communicate results. Observe that sound is produced by vibrating objects and give examples of vibrating objects that produce sound. Observe that volume is a property of sound that determines how loud the sound is and be able to describe what part of the vibrating object's motion determines the sound it produces. Describe the relationship between the pitch of a sound and the physical properties of the sound source (i.e., length of vibrating object, frequency of vibrations, and tension of vibrating string). Describe how the pitch of sound is different from the volume. Identify that sound energy needs a medium through which to travel. Compare how effectively sound travels through solids, liquids, and air. Demonstrate that vibrations in materials set up wavelike disturbances that spread away from the source. Construct a method to direct sound from the source to the receiver. Describe how energy can be stored in an elastic object or material by stretching it. Use diagrams to describe ways that the energy stored in a stretched object can be used to make objects move.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 4-5

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Building upon the K-3 expectations, all students in **Grade 4** will be able to:	Building upon the K-4 expectations, all students in **Grade 5** will be able to:
Use models to describe how the Earth's rotation on its axis causes one half of the Earth to always be illuminated by the Sun (day) and one half to not be illuminated by the Sun (night). Apply this model of the rotating Earth to explain why the Sun appears to move across the sky each day from east to west. Observe the size of the Sun and Moon in the sky. Use models to illustrate the approximate size and distance relationship between the Sun and Moon. Explain why the Sun and Moon appear to be similar in size when observed in the sky. Research and develop a short report on one of the planets in the Solar System. Compare the information learned in the reports. ***Also in Standard 5:*** Examine materials that compose soil (i.e., sand, clay, humus, gravel, water) and describe these on the basis of their properties (i.e., color, luster, granularity, texture, mass relative to size, particle size, ability to absorb water, pore space, ability to compact). Describe how certain soil properties affect the way in which soil is eroded and deposited by water. Create a model that can be used to describe how water moves from one place on Earth to another in a continuous cycle through the processes of evaporation, condensation, and precipitation. Use stream tables to observe the creation of landforms as water flows over and through the land. Describe changes that result from the flowing of water, using correct geographic terminology (i.e., canyon, delta, tributary). Describe changes to the water as it flows over land (i.e., color, transparency). Describe how fast-moving water and slow-moving water over the land affect erosion and deposition. Use stream tables to model and describe the effects of slope.	Use rulers, meter sticks, tapes, and watches to measure the distance objects travel in a given period of time and how much time it takes for an object to travel a certain distance. Organize the measurements in tables, and construct graphs based on the measurements. Reach qualitative conclusions about the speeds of the objects (faster versus slower). Demonstrate and explain how forces of different sizes and directions can produce different kinds of changes in the motion of an object. Observe that light travels in a straight line away from its source until it strikes an object. Observe that when light strikes an object, it can reflect off the object, transmit through the object, be absorbed within the object, or a combination of these phenomena. Give examples of light being reflected, transmitted, and/or absorbed by objects. Using the physical properties of objects, make predictions about how light will behave when it strikes the object. Categorize materials as transparent, translucent, absorbent or reflective based on how they interact with light. ***Also in Standard 6:*** Describe how to promote healthy digestion and recognize some symptoms that indicate disturbances associated with the normal functioning of the digestive system (i.e., stomach ache, flatulence). Identify, label the parts, and describe the basic functions of the human digestive tract including the mouth, esophagus, stomach, small intestine, large intestine (colon), rectum, and anus. Compare and contrast the human body digestive system with that of other animals e.g., earthworm, chicken, fish, crayfish, snail, cow. Identify external structures (i.e., legs) and behaviors (i.e., walking) of organisms that enable them to survive in their particular ecosystem and describe how these structures enable the organisms to respond to internal (i.e., hunger) and external (i.e., temperature, danger) cues.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 4-5

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Describe how the flow of water (fast or slow) is affected by the slope of the land, the amount and type of vegetation, and the landforms. Use stream tables to model the effect of human activity on erosion and deposition. Describe how human activity (i.e., building a dam, clear cutting a forest, bulldozing a roadway) affects the amount of erosion and deposition and changes the environment. Keep daily records of weather conditions (wind speed and direction, type and amount of precipitation, cloud cover and type, temperature) and use these records to identify short term and seasonal patterns in Delaware. Identify and describe different types of storm systems that occur in Delaware (i.e., tornadoes, hurricanes, thunderstorms, blizzards). From observed and gathered historical data, identify times of the year when these storms are most likely to occur. Select and use a variety of appropriate instruments (i.e., graduated cylinders, stream tables, hand lens, ruler, balances) for collecting, recording, and analyzing data obtained from stream table investigations. Communicate the results of stream table investigations through record sheets, oral and written observations, and drawings. ***Also in Standard 6:*** Compare and contrast structures that have similar functions in various organisms (e.g. eyes, ears, mouths). Explain that the function of the structure is similar although the structures may have different physical appearances (e.g., compare eyes of an owl with the eyes of a crayfish). Observe and identify structures of plants and describe the function of each structure. Explain that most plants produce many seeds, most of which do not germinate and grow into new plants. Sort and group plants and animals according to similarities in structures or functions of structures. Explain why the plants and animals have been grouped in this manner.	Research the ways that a variety of organisms respond to internal (i.e., need for food and shelter) and external (i.e., presence of predators) cues. Describe the similarities and differences among the organisms. ***Also in Standard 7:*** Identify plants and animals in an ecosystem (i.e., beach, woodland, marsh, meadow). Examine the life cycles of the plants and animals and identify factors in the ecosystem that are beneficial or harmful to the organisms at various stages in its life cycle (i.e., young fish are small which makes them able to hide in plants but this characteristic also makes them more vulnerable to predators). ***Also in Standard 8:*** Examine a variety of ecosystems such as marsh, pond, field, forest. Compare how the organisms, the habitat, and the food chains are similar and different in these ecosystems. Differentiate between an organism's "habitat" (where an animal lives) and its "territory" (an area claimed as its own space). Select an organism and describe its habitat and territory. Predict and describe how a dramatic increase or decrease in the population size of a single species within an ecosystem affects the entire ecosystem. Identify environmental factors that affect the growth and reproduction of organisms in an ecosystem (e.g., temperature can affect germination and soil moisture). Conduct investigations to simulate terrestrial and aquatic ecosystems and their interdependence. Demonstrate and describe how alteration of one part of the ecosystem (i.e., change in pH, over fertilization, addition of salt) may cause changes throughout the entire ecosystem. Categorize the organisms within an ecosystem according to the function they serve as producers, consumers, or decomposers. Explain why the organism was categorized this way.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 4-5

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<tr><td>Select a living organism and develop descriptions of how the organism responds to a variety of stimuli (i.e., light/dark, warm temperature/cold temperature) based on multiple observations and data collection (e.g., crayfish and Bess Beatles).

Observe, record, and describe changes in the health or behavior of an organism as a result of changes in its environment.

Also in Standard 7:
Compare the similarities and differences of offspring to their parents (e.g., crayfish, bean sprouts). Know that offspring receive characteristics from both parents.

Construct the life cycle of a bean plant through the use of diagrams. Describe the plant in different stages of its life cycle from seed, to seedling, to mature plant, to death, and explain how the structures of the plant change over time. Recognize that these stages of the life cycle are predictable and describable.

Research the life cycle of an organism. Diagram the life cycle of the organism and describe how the organism changes over time. Compare the life cycle of this organism to the life cycle of various other organisms. Recognize that all organisms go through a life cycle.

Describe how similar structures found on different organisms (e.g., eyes, ears, mouths) have similar functions and enable those organisms to survive and reproduce in different environments (e.g., eyes of owls versus eyes of crustaceans).

Recognize that there are variations among organisms of the same kind. Observe organisms of the same kind and describe how their physical appearances differ.

Also in Standard 8:
Predict, investigate and describe how plants can affect water flow, run off and erosion. Relate this knowledge to an ecosystem in Delaware (i.e., planting beach grass to stabilize dunes, planting grass on a slope to decrease soil erosion).</td><td>Identify the Sun as a source of energy that drives an ecosystem. Describe the path of energy from the Sun to the producers then to the consumer in the food chain. Recognize that an organism has dependent and independent relationships in an ecosystem.</td></tr>
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Building upon the K-3 expectations, all students in **Grade 4** will be able to:	Building upon the K-4 expectations, all students in **Grade 5** will be able to:
Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward. ***Also in Standard 3:*** Using books, computers, and other resources, search for ways that people use natural resources to supply energy needs for lighting, heating, and electricity. Report your results by making a poster, written report or oral presentation. ***Also in Standard 4:*** Using newspapers, the internet, and actual sky observations when possible, chart the appearance of the Moon in the night sky over the course of at least two months. Identify the basic pattern of the Moon's appearance. Classify the Moon's appearance by using the terms new, first quarter, full, last (third) quarter. Use photos gathered from robot probes, the Hubble telescope, and manned exploration of the Moon, to examine pictures of the planets and Moon. ***Also in Standard 5:*** Using newspapers, computer internet sites, and other information resources, identify weather conditions in different parts of the world. Compare this with the local weather in Delaware and discuss how weather conditions for a specific day may vary around the USA and world. Observe satellite photos showing change over time of landforms (i.e., Chesapeake Bay, Cape Henlopen, Delaware coastline) and predict future changes that may occur. Describe how these predictions may affect human activities (i.e., locations for building). ***Also in Standard 7:*** Explore how plants are grown using hydroponics. Identify the benefits of hydroponic agriculture in meeting human wants and needs. Observe seeded and seedless varieties of fruits (i.e., watermelon). Provide reasoning for why seedless fruits have been developed by scientists.	**Enduring Understanding: The development of technology and advancement in science influence each other and drive each other forward.** ***Also in Standard 2:*** Research and report on recycling of household materials (e.g., glass, newspaper, plastics) and how these materials are reused. ***Also in Standard 3:*** Recognize that solar energy, an inexhaustible source, is an alternative energy source to fossil fuels, an exhaustible source. Using books, computers and other resources, search for ways that we can use sunlight to heat and light our homes, and generate electrical energy. Report your results by making a poster, a written report or an oral presentation. ***Also in Standard 6:*** Identify safety equipment (e.g., goggles, gloves) and procedures (e.g., washing hands, wafting, not eating) used in classroom science investigations. Explain how these promote healthy living and prevent injuries. ***Also in Standard 8:*** Identify natural (i.e., wildfire, flood, drought) and man-made changes (forest clear cutting, input of pollutants, filling in of marshland) to an ecosystem. Discuss how these changes affect the balance of an ecosystem.

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Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 6-8

Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence?
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Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.	**Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.**	**Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.**
Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.	Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.	Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
Design and conduct investigations with controlled variables to test hypotheses.	Design and conduct investigations with controlled variables to test hypotheses.	Design and conduct investigations with controlled variables to test hypotheses.
Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.	Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.	Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, to display and facilitate analysis of data. Compare and question results with and from other students.
Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.	Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.	Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.	Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.	Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
Use mathematics, reading, writing, and technology in conducting scientific inquiries.	Use mathematics, reading, writing, and technology in conducting scientific inquiries.	Use mathematics, reading, writing, and technology in conducting scientific inquiries.

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Also in Standard 3: Relate that electrical energy carried by charges in a circuit is transferred to devices in the circuit and is usually changed into (transformed) different kinds of energy by these devices (e.g., light bulbs change electrical energy into light and heat energy, motors turn the electrical energy into energy of motion). Trace the flow of energy from electrical energy to other forms of energy, such as light. Express whether energy was transferred, transformed or both. Construct both series and parallel circuits to investigate and describe how multiple devices in series or parallel (bulbs, motors) perform (dim versus bright, fast versus slow). Describe how the way the devices are connected affects the functioning (i.e., dim versus bright) of the device and relate this to how much electrical energy is received. Conduct investigations on a moving object and make measurements of time and distance traveled and determine the average speed of moving objects. Graph and interpret time versus distance graphs for constant speed. Use the graphs to describe how the position of an object changes in a time interval. Describe how the speed of an object depends on the distance traveled and the travel time. Explain how the motion of an object can be described by its position, speed, and direction of motion.	***Also in Standard 2:*** Recognize that all matter consists of particles and how the particles are arranged determines the physical state. Use the particle model to describe solids, liquids, and gases in terms of the packing and motion of particles. Measure and record the temperature of ice water as it is heated. Plot the graph of measurements taken and interpret the change of phase graph using the particle model, identifying the states of matter. Analyze a standard change of phase graph of water. Using the particle model, identify where water is a solid, liquid or gas, is freezing/melting or evaporating/condensing. Relate the states of matter to the changes (increase, decrease) of energy in the system. Make a model or drawing of particles of the same material in solid, liquid, and gas state. Describe the arrangement, spacing and energy in each state. Calculate the density of various solid materials. Use density to predict whether an object will sink or float in water. Given the density of various solids and liquids, create a density column and explain the arrangement in terms of density. Use physical properties to distinguish and separate one substance or material from another.	***Also in Standard 2:*** Conduct simple investigations in which a variety of materials (sand, water, light colored materials, dark colored materials) are exposed to light and heat energy. Measure the change in temperature of the material and describe any changes that occur in terms of the physical properties of the material. Conduct investigations, using a variety of materials, to show that some materials conduct heat more readily than others. Identify these materials as conductors or insulators. ***Also in Standard 3:*** Design and carry out investigations to determine how changing the mass of an object or changing its speed changes its kinetic energy. Explain that gravitational potential energy (GPE) is the energy of position (above the Earth's surface) and that it depends on the object's mass and height above the ground. Relate that lifted objects have GPE and that the size of an object's GPE depends on its mass and the vertical distance it was lifted. Make a graph to demonstrate and describe how the GPE changes as the height of an object is increased or decreased. Explain that the mechanical energy of an object is the sum of its kinetic energy and its potential energy at any point in time. Identify the mechanical energy of objects in different circumstances and identify whether the

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Give examples of objects at rest, and identify the forces that act on an object while it remains at rest (gravity, supportive forces, friction, other pushing or pulling forces). Explain that if the object is not moving, it must have at least two forces acting on it that are balanced. Give examples of moving objects and identify the forces that act on these objects. Select examples where only one force acts on the object and examples where two or more forces act on the object. Explain that unbalanced forces acting on an object will change its speed, direction of motion or both. Conduct investigations to describe how the relative directions of forces simultaneously acting on an object (reinforce or cancel each other) will determine how strongly the combination of these forces influences the motion of the object. Conduct investigations and describe how a force can be directed to increase the speed of an object, decrease the speed of the object or change the direction in which the object moves. Conduct investigations using simple machines to demonstrate how forces transfer energy. Explain that simple machine may change the direction of an applied force (directional advantage) or the size of the force that is applied (mechanical advantage) but that the amount of energy transferred by the simple machine is equal to the amount of energy transferred to the simple machine.	Distinguish between homogeneous and heterogeneous mixtures. Using their physical properties, design and conduct an investigation to separate the components of a homogeneous or heterogeneous mixture. Recognize that a homogeneous mixture is a solution. Prepare solutions of different concentrations recognizing that the properties of the solution (color, density, boiling point) depend on the nature and concentration of the solute and solvent. Conduct investigations to determine the effect of temperature and surface area of the solute on the rate of solubility. Describe the rate of solubility using the particle model. Conduct investigations to determine the effect of temperature on saturation point. Construct a solubility curve based on data collected. Describe solubility and saturation point using the particle model. Conduct investigations to demonstrate the process of diffusion. Use the particle model to describe the movement of materials from an area of higher concentration to an area of lower concentration. Show that mass is conserved when adding a solute to a solvent (mass of solvent + mass of solute = total mass of solution).	mechanical energy consists of KE, PE or both (i.e., a ball at rest at the top of an incline and in its motion part of the way down the incline or a model plane driven by a 'rubber band' motor, etc.). Interpret graphical representations of energy to describe how changes in the potential energy of an object can influence changes in its kinetic energy. Describe how the motion of water particles in a glass of cold water is different from the motion of water particles in a glass of hot water. Explain that sound energy is mechanical energy that travels in the form of waves. Use the Particle Model to explain why sound waves must travel through matter, and that sound travels more effectively through solids and liquids than through gases. Model and describe how sound energy travels through solids, liquids, and gases. Use the properties of sound waves and the Particle Model to describe how the pitch of two waves can be different and how the loudness of two waves can be different. Explain that heat energy and sound energy both make the particles of a substance move. Use models to explain how the particles respond differently to these types of energy. Use models to explain why sound travels much faster through substances than heat energy does.

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Explain that the transfer of energy from one object to another is caused by the exertion of a force. Use the size of the force and the distance over which the force acts to compare how much energy is transferred into a simple machine to how much energy is transferred out of a simple machine. Design a device that relies on the directional and/or mechanical advantage of a simple machine to perform a task (e.g., lift a weight, move a heavy object). Identify the forces and motions involved, the source of the energy used to complete the task, and how the energy is used by the simple machine. Show how electrical energy carried by currents in wires can be used to create magnetic fields. Demonstrate how these fields exert magnetic forces on permanent magnets. Explain how these magnetic forces in electric motors are used to change the electrical energy into the energy of motion. ***Also in Standard 5:*** Use appropriate instruments and tools to identify the sedimentary rocks limestone, shale, and sandstone. Infer the environmental conditions in which these rocks formed. Examine sedimentary rock formations. Use relative dating and fossil evidence to correlate sedimentary rock sequences. Infer the succession of environmental events that occurred from one rock sequence to another (transgression or regression of the seas).	***Also in Standard 3:*** Describe how heat energy when added to a substance, will increase its temperature or change its state. Explain that as more heat energy is added to a substance, the particles' vibrations increase and the spacing between the particles increases, but the size of the particles stays the same. ***Also in Standard 5:*** Create models that simulate the amount of salt, frozen, fresh, and potable water available on Earth's surface. Compare total water supply on Earth to the amount of potable water available for human use. Calculate the ratio/percent of water generally found in solid, liquid and gaseous form on or within the Earth's surface and use this ratio to compare the amounts of water stored in different states. Use diagrams of the hydrologic cycle to show and describe the circulation of water through the Earth's crust, oceans, and atmosphere. Use the particle model to describe solids, liquids, and gases in terms of the packing, motion of particles, and energy gain or loss. Apply this to the processes of evaporation, condensation, and precipitation in the water cycle. Explain how heat energy drives the water cycle.	Explain that the electromagnetic waves from the sun consist of a range of wavelengths and associated energies. Explain that the majority of the energy from the sun reaches Earth in the form of infrared, visible, and ultraviolet waves. Use diagrams to demonstrate the differences in different types of electromagnetic waves. Plan and conduct an experiment to identify the presence of UV and IR waves in sunlight or other sources of electromagnetic waves. Use evidence to explain the presence of each. Explain that the transfer of energy from one object to another is caused by the exertion of a force. Create an energy chain to show how forces can change the mechanical energy of an object. Describe how the distance over which the forces act will influence the amount of energy transferred (and when appropriate, the amount of energy transformed). Give examples of how mechanical energy can be transferred to (or away from) an object and describe the changes that can take place in the motion of the object because of this energy transfer, (e.g., pulling on a trailer to start it moving or using friction to slow an object and bring it to rest). Use diagrams to trace and describe the transfer of energy through a physical system (for example, the erosion effects of water flowing down an unprotected slope).

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Use the correlated sedimentary rock sequences to support Earth's geologic time scale. Investigate and describe how factors such as abrasion, frost/ice wedging, temperature changes, and plant growth cause physical weathering of rocks. Infer the environment in which the sedimentary particles were formed based on the results of weathering. Investigate how weathered materials are transported (i.e., mass movement and wind, water, and ice processes) in the process of erosion. Explain how erosion shapes rock particles. Describe the process by which eroded materials can form horizontal layers of sedimentary rock. ***Also in Standard 6:*** Label and describe the functions of the basic parts of the circulatory system including the heart, arteries, veins and capillaries. Label and describe the functions of the basic parts of the male and female reproductive systems. Label and describe the functions of the basic parts of the respiratory system including the trachea, bronchi and lungs. Label and describe the functions of the basic parts of the digestive tract including the mouth, esophagus, stomach, small intestine, liver, large intestine (colon), rectum and anus.	Use models or diagrams to explain how water stored underground (groundwater and aquifers) and water stored above ground (lakes, rivers, air, etc…) interact to form a continuous cycle. Investigate, through the use of models, how water acts as a solvent and as it passes through the water cycle it dissolves minerals, gases, and pollutants and carries them to surface water and ground water supplies. Conduct investigations and use the data to describe the extent to which the permeability and porosity of a soil sample affect the rate of water percolation. Use topographic maps to locate Delaware watersheds and to identify the bodies of water into which they drain. Analyze and describe the relationship between elevation of land and the flow rate of water in a watershed. Conduct tests including temperature, pH, salinity, dissolved oxygen, turbidity, nitrate, and phosphate to determine the potability of local water samples. Identify macro-invertebrates in a local stream and apply this identification in determining the stream's ecological health. ***Also in Standard 6:*** Identify and apply criteria for determining whether specimens or samples are living, dead, dormant or nonliving.	Use the Particle model to explain how mechanical waves can transport energy without transporting mass. Give examples that support the transfer of energy without any net transfer of matter. Explain that the frequency and amplitude are two characteristics of waves that determine the mechanical energy carried and delivered by a sound wave per unit of time. Use diagrams to explain how each of these properties will influence the KE of the particles in the substance when a sound wave passes through the substance. Give an example of a high frequency sound wave that delivers small quantities of energy every second and explain how this is possible. Give an example of a low frequency sound wave that delivers large quantities of energy every second and explain how this is possible Use the Particle Model to explain how heat energy is transferred through solid materials (conduction). Give examples of materials that are good 'conductors' of heat energy and examples of materials that are poor conductors of heat energy and how both types of materials are used in typical homes. Use the Particle Model to describe the difference between heat energy transfer in solids and heat energy transfer in liquids and gases (i.e., the differences between conduction and convection). Conduct simple investigations to demonstrate that heat energy is transferred from one material to another in

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Conduct simple investigations (how the body reacts to exercise, changes in temperature, etc.) to determine how the systems in the human organism respond to various external stimuli to maintain stable internal conditions. ***Also in standard 7:*** Recognize that fossils indicate that many organisms that lived long ago are extinct. Use index fossils to determine the relative age of rock sequences, and environmental conditions at the time of formation. Recognize, through fossil evidence, that some species can be traced back in geologic time.	Classify organisms based on shared characteristics into currently recognized kingdoms and justify their placement. Give examples of organisms from each kingdom. Observe and sketch cells using microscopes and other appropriate tools. Compare and contrast plant, animal, protist, and bacterial cells by noting the presence or absence of major organelles (i.e., cell membrane, cell wall, nucleus, chloroplasts, mitochondria and vacuoles) using the sketches and other resources. Research external conditions needed by a variety of organisms for survival such as temperature, turbidity, pH, salinity, and amount of dissolved oxygen, phosphates, and nitrates. Predict how organisms may respond to changes in these external conditions based on research findings. ***Also in Standard 7:*** Recognize that reproduction is a process that occurs in all living systems and is essential to the continuation of the species. Use models or diagrams to identify the structures of a flowering plant that produce eggs and sperm and explain that plants as well as animals can reproduce sexually. Given varied scenarios (including one or two parent reproduction, and having traits identical to or different than the parents), classify offspring as either sexually or asexually produced and justify your response. Compare and contrast asexual and sexual reproduction in terms of potential variation and adaptation to a static or	predictable ways (from materials at higher temperatures to materials at lower temperatures), until both materials reach the same temperature. Explain how the addition or removal of heat energy can change an object's temperature or its physical state. Conduct simple investigations involving changes of physical state and temperature. Relate that there is no change in temperature when a substance is changing state. Explain that energy transformation and energy transfer are different processes and that energy transformations can take place during an energy transfer. Give examples of energy transformations that take place during an energy transfer. Give examples of energy transfers that do not include energy transformations. Give examples of energy transformations that take place without any energy transfer. Use energy chains to trace the flow of energy through physical systems. Indicate the energy transfers and the energy transformations that are involved in the processes (for example, the lighting of an electric lamp in a region serviced by a hydroelectric (or coal fueled) electric power plant, or the sediment that clouds a stream after a heavy rainfall). Trace the flow of the energy carried by the light when the light strikes a material and is reflected from, transmitted through, and/or absorbed by the material. Describe the energy transfers and transformations that take place when

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	changing environment. Relate advantages and/or disadvantages of each strategy. Make a simple labeled drawing of human reproductive cells. Indicate that the sex cells (sperm and egg) each have half of the chromosomal number (23) as a fertilized egg (46). The fertilized egg has the same number of chromosomes as each of the body cells of the new organism. Recognize that different organisms may have different numbers of chromosomes and that the number of chromosomes does not relate to the complexity of the organism. Make a simple labeled drawing of asexual reproduction as it occurs in sexually produced organisms at the cellular level. Indicate that resulting cells contain an identical copy of genetic information from the parent cell. Describe the relationship between genes, chromosomes, and DNA in terms of location and relative size. Use single trait Punnett squares to examine the genotypes of individuals and indicate which individuals will express dominant or recessive traits. Justify the indication by relating that dominant alleles appearing heterozygously or homozygously are expressed or that two recessive alleles (homozygous) are required for an offspring to express a recessive trait phenotypically. Use pedigrees to illustrate the heritability of dominant and recessive alleles over several generations.	light energy is absorbed by a material. Conduct investigations to show that materials can absorb some frequencies of electromagnetic waves, but reflect others or allow them to transmit through the material. Use this selective absorption process to explain how objects obtain their color, how materials like sunscreen can serve to protect us from harmful electromagnetic waves and how selective absorption contributes to the Greenhouse Effect. Trace what happens to the energy from the Sun when it reaches Earth and encounters various materials, such as, atmosphere, oceans, soil, rocks, plants, and animals. Recognize that these materials absorb, reflect and transmit the electromagnetic waves coming from the sun differently. Conduct investigations to determine how the physical properties of materials (e.g., size, shape, color, texture, hardness) can account for the effect the materials have on sunlight and the degree of change observed in the materials (for example, dark cloth absorbs more heat than light cloth, clear water transmits more light than murky water, and polished materials reflect more light than dull materials). Use the properties of water and soil to explain how uneven heating of Earth's surface can occur. Conduct an investigation that shows how water and soil are heated unequally by sunlight.

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	Research and report on the contributions of Gregor Mendel and other genetic researchers and how their contributions altered the body of scientific knowledge. Identify "kingdom" as the first main level of the standard classification system. Observe a variety of living organisms and determine into which kingdom they would be classified.	Describe how this can be used to explain unequal heating of the Earth's surface, producing atmospheric movements that influence weather. ***Also in Standard 4:*** Use models to describe how the relative positions of the Sun, Moon, and Earth account for Moon phases, eclipses, and tides. Describe how the relative positions of the Earth, Moon and Sun can cause high and low tides, and unusually high or low tides. Demonstrate an understanding of the components of our Solar System and their characteristics, including the Moon, the Sun, the planets and their moons, extra-solar planets, and smaller objects such as asteroids and comets. Construct scale models of the Solar System in order to describe the relative sizes of planets and their distances from the Sun. Demonstrate an understanding of the motion of the bodies in our Solar System. Use models, charts, illustrations, and other suitable representations to predict and describe regular patterns of motion for most objects in the Solar System. Explain how the Sun is the central and largest body in our Solar System and the source of the light energy that hits our planet. Use models to explain how variations in the amount of Sun's energy hitting the Earth's surface results in seasons.

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Observe, measure, and predict changes in weather using atmospheric properties (wind speed and direction, cloud cover and type, temperature, dew point, air pressure, and relative humidity). Describe how air pressure and temperature change with increasing altitude and/or latitude.

Explain how uneven heating of Earth’s components – water, land, air – produce local and global atmospheric and oceanic movement. Describe how these local and global patterns of movement influence weather and climate.

Investigate the rate at which different Earth materials absorb heat. Explain how these differences in heat absorption causes air pressure differences that result in convection currents (i.e., local land and sea breezes).

Use a variety of models, charts, diagrams, or simple investigations to explain how the Sun’s energy drives the cycling of water through the Earth’s crust, oceans, and atmosphere.

Examine maps of ocean currents and trace the origin and flow of such currents to explain the transfer of heat energy. Identify which currents have dominant influence on the Delaware coast.

Describe how origin affects an air mass’s temperature and moisture content.</td></tr>
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		Describe how the interaction of air masses produces different fronts (warm, cold, and stationary) that influence our weather. Describe how the formation of clouds is influenced by the dew point, environmental temperature and amount of particles in the air. Explain how various lifting mechanisms affect cloud formation. Use cloud characteristics (altitude, composition, and form) to predict the weather. Discuss how different cloud types are indicators of weather and weather systems such as frontal systems and hurricanes. **Also in Standard 7:** Research and report on reproductive strategies of different organisms (i.e., broadcast spawning versus nurturing parenting) that allow them to be successful. Observe a variety of organisms and explain how a specific trait could increase an organism's chances of survival. Conduct a natural selection simulation to demonstrate how physical adaptations (i.e., protective camouflage, long neck for food gathering, muscular legs for running, heavy beak for nut cracking, etc…) have selective advantages for an organism. Research and report on beneficial physical adaptations of a variety of organisms.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 6-8

Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence?
Why is it necessary to justify and communicate an explanation?
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What do we mean in science when we say that we stand on the shoulders of giants?

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Building upon the K-5 expectations, all students in **Grade 6** will be able to:	Building upon the K-6 expectations, all students in **Grade 7** will be able to:	Building upon the K-7 expectations, all students in **Grade 8** will be able to:
		Investigate and discuss how short-term physiological changes of an organism (e.g., skin tanning, muscle development, formation of calluses) differ from long-term evolutionary adaptations (e.g., white coloration of polar bears, seed formation in plants) that occur in populations of organisms over generations. Conduct simulations to investigate how organisms fulfill basic needs (i.e., food, shelter, air, space light/dark, and water) in a competitive environment. Relate how competition for resources can determine survival. Examine an assortment of plants and animals and use simple classification keys, based on observable features, to sort and group the organisms. Identify a variety of reasons for extinction of a species. Use research on a variety of extinct organisms to speculate causes of extinction (i.e., inability to adapt to environmental changes). ***Also in Standard 8:*** Survey the diversity of organisms in a local or model ecosystem. Recognizing that a population consists of all individuals of a species that occur together at a given place and time, describe how to estimate and then calculate the size of a large population of a variety of organisms. Chart the diversity of the organisms in the ecosystem.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 6-8

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		Categorize populations of organisms according to the roles (producers, consumers, and decomposers) they play in an ecosystem. Describe and explain how factors (i.e., space, food, water, disease) limit the number of organisms an ecosystem can support. Construct a data table or line graph to show population changes of a selected species over time. Describe the population changes portrayed by the graph. Observe graphs or data tables showing both the population growth of a species and the consequences of resource depletion on the population. Analyze the data and explain the effect that may occur from exponential growth of a population (given finite resources). Investigate and discuss how short-term physiological changes of an organism (e.g., skin tanning, muscle development, formation of calluses) differ from long-term evolutionary adaptations (e.g., white coloration of polar bears, seed formation in plants) that occur in a group of organisms over generations. Investigate local areas, disturbed and undisturbed, that are undergoing succession (i.e., abandoned gardens, ditch banks, and the edge of a forest).

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		Predict how plant communities that grow in the area may change over time and how their presence determines what kinds of animals may move into and out of the areas. Construct food webs and identify the relationships among producers, consumers, and decomposers. Design food webs and trace the flow of matter and energy (beginning with the Sun) through the food web.
Enduring Understanding: The development of technology and advancement in science influence and drive each other forward. **Also in Standard 3:** Compare the differences in power usage in different electrical devices/appliances. Discuss which devices/appliances (i.e., washer, dryer, refrigerator, electric furnace) are manufactured to require less energy. Select one device/appliance, research different brands and their energy usage, determine which would be the better buy, and report on the findings. ***Also in standard 6:*** Use knowledge of human body systems to synthesize research data and make informed decisions regarding personal and public health. Research and report on how body systems are affected by lifestyle choices such as diet or exercise (for example lack of exercise leads to cardiovascular disease).	**Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.** ***Also in Standard 2:*** Select a manufactured item and identify its component materials. Explain how the physical properties of the materials contribute to the function of the item. Discuss the social, economic, and/or environmental consequences of the production of new materials to meet human wants and needs. ***Also in Standard 5:*** Research and report on the processes used by municipalities to ensure water taken from local reservoirs is safe to return to the environment. Investigate and report on legislation such as the Clean Water Act and its impact on the quality of Delaware water.	**Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.** ***Also in Standard 3:*** Identify different forms of alternative energy (i.e., solar, wind, ocean waves, tidal and hydroelectric systems). Research and report on the use of this alternative form of energy. Discuss and compare findings to describe the advantages and disadvantages of different kinds of alternative energy. ***Also in Standard 4:*** Analyze data on sunrise and sunset times (in terms of length of daylight) and describe patterns. Explain the reason for the patterns by using models or computer simulations of the Earth and Sun.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 6-8

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	List ways in which human intervention can help maintain an adequate supply of fresh water for human consumption. Apply knowledge and skills learned about water as a resource to study local sources of drinking water and devise a water quality stewardship plan. ***Also in Standard 6:*** Use various indicators (pH, turbidity, nitrates, phosphates, salinity, and macro-invertebrate surveys) to establish the health and potential potability of local bodies of water. ***Also in Standard 7:*** Research and report on selective breeding. Select an organism (e.g., race horses, pedigree dogs, drought resistant plants) and trace its history of development and the traits of the plant or animal that were enhanced by selective breeding. Recognize that the health profession uses pedigree charts to trace genetic disorders in past generations make predictions for future generations. Research and report on a chromosomal disorder. Complete a simulated pedigree for a fictional family based on your research. ***Also in Standard 8:*** Explain how sanitation measures such as sewers, landfills, and water treatment are important in controlling the spread of organisms that contaminate water and cause disease.	Using internet, newspaper, and actual observations of the night sky for at least two months, collect data on the Moon's appearance, and moonrise and moonset times. Analyze the data to describe the observable patterns (phases). Explain why the Moon's appearance changes in a repeating cyclical pattern. Use a variety of resources (e.g., NASA photographs, computer simulations) to compare and contrast the physical properties (i.e., temperature, size, composition, surface features) of planets. Recognize that spin offs are products which have undergone a technology transfer process from research to public use. Research spin-offs from the space program that have affected our everyday lives (i.e., Velcro, smoke detectors, cordless tools). ***Also in Standard 5:*** Discuss the origin and identify characteristics (i.e., air circulation pattern, wind speed, temperature and dew point, and air pressure) of storm systems including hurricanes, Nor' easters, tornadoes, thunderstorms, and mid-latitude cyclones. Explain how these weather events can transfer heat. Describe the environmental, economic, and human impact of these storms. Examine isobars on weather maps to describe how wind (moving air) travels from a region of high pressure to a region of low pressure. Apply this knowledge to explain the cause of wind.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 6-8

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<tr><td></td><td></td><td>Record and interpret daily weather measurements over an extended period of time using a variety of instruments (i.e., barometer, anemometer, sling psychrometer, rain gauge, and thermometer) in order to predict and to identify weather patterns.

Construct and use surface station models to represent local atmospheric data and interpret weather patterns on meteorological maps.

Examine satellite imagery pictures and use these images to identify cloud patterns and storm systems.

Use weather maps to describe the movement of fronts and storms and to predict their influence on local weather.

Also in Standard 8:
Research and analyze data on human population changes that have occurred in a specific Delaware ecosystem. Discuss reasons for changes in human population and explain how these changes have affected the biodiversity of local organisms and availability of natural resources in the given ecosystem (e.g., habitat loss, water quality, preservation/concentration efforts).

Identify ways in which invasive species can disrupt the balance of Delaware as well as other ecosystems (i.e., competition for resources including habitat and/or food). Research and report on an invasive species, indicating how this species has altered the ecosystem.</td></tr>
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Also in Standard 6:
Research the sequence of events that led to the formation of the cell theory and correlate these events with technological advancements (e.g., hand lens, microscopes, and staining techniques).</td><td>Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.

Also in Standard 4:
Describe how scientists have historically confirmed that the Earth is round, not flat.

Describe how scientists have acquired knowledge about components of our Solar System. Recognize the importance of people and technologies that have led to our current understanding of space.</td></tr>
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Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 9-12

Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence? Why is it necessary to justify and communicate an explanation? Essential Question: How do science and technology influence each other? Essential Questions: How have past scientific contributions influenced current scientific understanding of the world? What do we mean in science when we say that we stand on the shoulders of giants?			
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Building upon the K-8 expectations, all students in **Grade 9** will be able to:	Building upon the K-9 expectations, all students in **Grade 10** will be able to:	Building upon the K-10 expectations, all students in **Grade 11** will be able to:	Building upon the K-11 expectations, all students in **Grade 12** will be able to:
Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation. Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation. Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis. Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.	**Enduring Understanding: Scientific inquiry involves asking scientifically oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.** Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation. Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis. Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.	**Enduring Understanding: Scientific inquiry involves asking scientifically oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.** Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation. Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis. Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.	**Enduring Understanding: Scientific inquiry involves asking scientifically oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.** Identify and form questions that generate a specific testable hypothesis that guide the design and breadth of the scientific investigation. Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis. Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 9-12

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Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence. Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information. Use mathematics, reading, writing and technology when conducting scientific inquiries. ***Also in Standard 2:*** Describe the relative charge, approximate mass, and location of protons, neutrons, and electrons in an atom. Classify matter as mixtures (which are either homogeneous or heterogeneous) or pure substances (which are either compounds or elements.) Classify various common materials as an element, compound or mixture. Describe isotopes of elements in terms of protons, neutrons, electrons, and average atomic masses. Recognize that isotopes of the same element have essentially the	Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence. Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information. Use mathematics, reading, writing and technology when conducting scientific inquiries. ***Also in Standard 6:*** Use microscopes to identify similarities and differences among a variety of cells (e.g., muscle, nerve, epithelial, blood, adipose), and explain how structural variations relate to the function that each of the cells performs. Use fluid mosaic models of the plasma membrane to explain how its structure regulates the movement of materials across the membrane. Show how water moves in and out of cells down a concentration gradient. Recognize that this process, known as osmosis, requires no input of energy.	Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence. Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information. Use mathematics, reading, writing and technology when conducting scientific inquiries. ***Also in Standard 3:*** Conduct investigations to identify how the rotational kinetic energy of an object depends on the object's mass, angular speed (rpm) and its geometry (for example; solid and hollow spheres, solid and hollow cylinders, rings). Conduct investigations to show that rolling objects have two kinds of kinetic energy, linear kinetic energy (LKE), and rotational kinetic energy (RKE). For example, a ball released on a ramp from a height, h, will consistently reach the bottom of the ramp with less linear kinetic energy than its GPE at the top of the ramp. The RKE of the rolling object explains the difference.	Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence. Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information. Use mathematics, reading, writing and technology when conducting scientific inquiries. ***Also in Standard 3:*** Explain that the quantity of radiant energy delivered to a surface every second can be viewed in two different ways. Use the concept of waves to describe that the energy delivered by electromagnetic radiation depends on the amplitude and frequency of the electromagnetic waves. Use the particle model of electromagnetic radiation (energy is carried by packets of electromagnetic energy called photons) to explain that the radiant energy delivered depends on the frequency of the radiation and the number of packets striking the surface per second.

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same chemical properties that are determined by the proton and electron number. Use the Periodic Table to identify an element's atomic number, valence electron number, atomic mass, group/family and be able to classify the element as a metal, non-metal or metalloid. Investigate differences between the properties of various elements in order to predict the element's location on the Periodic Table. Use the Periodic table to predict the types of chemical bonds (e.g., ionic or covalent) in a variety of compounds. Use models or drawings to illustrate how molecules are formed when two or more atoms are held together in covalent bonds by "sharing" electrons. Use models or drawings to illustrate how ionic compounds are formed when two or more atoms "transfer" electrons and are held together in ionic bonds.	Design a controlled experiment to investigate the capacity of the cell membrane to regulate how materials enter and leave the cell. Construct cell models (e.g., phenolphthalein-agar cubes, potato-iodine cubes) to investigate the relationship among cell size, surface area to volume ratio and the rates of diffusion into and out of the cell. Explain why large organisms have developed from many cells rather than one large cell. Use molecular models to explain how carbon atoms uniquely bond to one another to forma large variety of molecules, including those necessary for life (e.g., polysaccharides, polypeptides). Observe formulas and diagrams of compounds found in food (fats, proteins, carbohydrates). Identify elements that comprise these compounds. Observe and recognize that unicellular organisms take in food from their environment and chemically digest it (if needed) within their cell body.	Explain that when a chemical reaction takes place and energy is released, the reaction results in molecules that have a lower chemical energy and if energy must be added for a chemical reaction to take place, the molecules that result from that reaction have higher chemical energy. Use the inverse square law to describe how the force of gravity changes over long distances (for example, describe the forces acting on the Voyager Space Probes as they moved through the solar system). Conduct investigations to determine the relative sizes of static and kinetic frictional forces acting between two surfaces. Conduct investigations to determine what variables (mass, normal force, surface area, surface texture, etc.) influence the size of frictional forces that act between two objects. Give examples in which static friction is a force of propulsion, initiating the motion of an object. Use force diagrams to illustrate the forces acting on the object during this propulsion process.	Use the model of discrete electronic energy states in an atom to describe how the atom can emit or absorb packets of electromagnetic energy (photons) having specific energies. Demonstrate how prisms, diffraction gratings or other optical devices can be used to analyze the light coming from different substances and how this analysis can be useful in the identification of elements and compounds. Use diagrams to show how concave reflecting devices and convex lenses can be used to collect and focus EM waves. Recognize that the characteristics of these devices are different for different groups of EM waves (radio waves, microwaves, infrared waves, visible waves, etc.). Create light ray diagrams to illustrate how converging devices are used to collect and focus waves in scientific devices (for example, telescopes and microscopes). ***Also in Standard 4:*** Describe how nuclear fusion reactions change over time and lead to the creation of elements (and the evolution of stars).

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Explore the extent to which a variety of solid materials conduct electricity in order to rank the materials from good conductors to poor conductors. Based on the conductivity data, determine patterns of location on the Periodic Table for the good conductors versus the poor conductors. Conduct investigations to determine the effect of heat energy on the change of state (change of phase) of water. Sketch and interpret graphs representing the melting, freezing, evaporation and condensation of water. Recognize that molecular and ionic compounds are electrically neutral. Use a model or a diagram to explain water's properties (e.g., density, polarity, hydrogen bonding, boiling point, cohesion, and adhesion) in the three states of matter. Cite specific examples of how water's properties are important (i.e., water as the "universal"). Separate mixtures into their component parts according to their physical properties such as melting point, boiling point, magnetism, solubility and particle size.	Recognize that both mechanical and chemical processes are necessary in digestion for multi-cellular organisms to get molecules that come from food to enter the cells. Trace the process whereby nutrients are transported to cells where they serve as building blocks for the synthesis of body structures and as reactants for cellular respiration. Explain the processes used by autotrophs to transform light energy into chemical energy in the form of simple sugars. Give examples of how these compounds are used by living things as sources of matter and energy. Describe the process by which water is removed from sugar molecules (dehydration synthesis) to form carbohydrates and is added to break them down (hydrolysis). Describe photosynthesis as an energy storing process and explain how environmental factors such as temperature, light intensity, and the amount of water available can affect photosynthesis.	Use force diagrams to describe how static friction can prevent an object (that is subject to another force) from moving. Draw force diagrams to illustrate the action of friction when it acts to slow-down an object. Use an energy argument to describe how friction slows down a moving object. Describe the factors that contribute to the size of an electric forces acting between charged particles (i.e., the size of an electric force depends upon the size of the charges involved and the distance between the charges). Recognize that the electric force is an inverse square force like the gravitational force. Use a sketch of this force to describe how its influence changes as the distance between the charges increases. Describe how many of the forces acting between objects (friction and normal forces) and acting within objects (tensions, compressions and elastic forces) are manifestations of the electromagnetic forces that act between atoms and molecules in substances.	Compare and contrast the age, temperature, and size of our Sun to other stars. Discuss the many ways in which the Sun influences Earth including the role of gravity, coronal mass ejections, and electromagnetic radiation including gamma photons. Describe the relative size differences and distances between planetary systems, stars, multiple-star galaxies, star clusters, galaxies, and galactic groups in the Universe. Describe how our knowledge of the history of the Universe is based on electromagnetic energy that has traveled vast distances and takes a long period of time to reach us. Explain the life history of stars in terms of luminosity, size and temperature using the Hertzsprung-Russell Diagram. Compare and contrast stellar evolution based on mass (black hole, neutron star, white dwarf). Describe how the composition of stars can be determined by analysis of their spectra. Compare the elements that compose stars to those that compose Earth.

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Explain how the properties of the components of the mixture determine the physical separation techniques used. Describe how the process of diffusion or the movement of molecules from an area of high concentration to an area of low concentration (down the concentration gradient) occurs because of molecular collisions. Explore how various solutions conduct electricity and rank the liquids from good conductors to poor conductors. Explain the characteristics that allow some solutions to have better electrical conductivity than others. Measure the pH of a solution using chemical indicators to determine the relative acidity or alkalinity of the solution. Identify the physical properties of acids and bases. Investigate factors that affect the materials' solubility in water and construct solubility curves to compare the extent to which the materials dissolve.	Investigate and describe the complementary relationship (cycling of matter and the flow of energy) between photosynthesis and cellular respiration. Compare the amount of chemical potential energy stored in chemical bonds of a variety of foods (calorimetry). Recognize that equal amounts of different types of food contain different amounts of energy. Investigate the role of enzymes (e.g., protease, amylase and lipase) in the rate of chemical breakdown of a variety of foods. Investigate how various factors (temperature, pH, enzyme/substrate concentration) affect the rate of enzyme activity. Illustrate how nerve cells communicate with each other to transmit information from the internal and external environment often resulting in physiological or behavioral responses.	Use diagrams or models to show how the electric forces acting between molecules can explain the presence of these forces. Use diagrams to show the similarities between the magnetic field of a permanent magnet and the magnetic field created by an electric coil. Conduct investigations to show how forces acting between permanent magnets and conducting coils carrying electric currents can be used to create electric motors. Use diagrams to show how magnets and rotating coils can be used to create electric currents. Use vector diagrams to illustrate the forces that act within the nucleus. Recognize that the stability of a nucleus depends upon the repulsive electric forces acting between the protons and the attractive nuclear forces acting between all protons and neutrons in the nucleus.	***Also In Standard 8:*** Identify and measure biological, chemical and physical indicators within a given ecosystem (pH, dissolved oxygen, macro invertebrate and other indicator species, salinity). Using models, computer simulations, or graphic representations, demonstrate how, changes in these indicators may affect interactions within ecosystems. Evaluate the current health of the ecosystem and suggest possible interventions for mitigation. Using graphs of population data of a predator and its prey, describe the patterns observed. Explain how the interactions of predator and prey generate these patterns, and predict possible future trends in these populations. Analyze and explain the short-term impact of a natural disaster on the biological, chemical, and physical components of the affected ecosystem and their associated interrelationships, including geochemical cycles and food webs.

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Conduct and explain the results of simple investigations to demonstrate that the total mass of a substance is conserved during both physical and chemical changes. Balance simple chemical equations and explain how these balanced chemical equations represent the conservation of matter. ***Also in Standard 3:*** Use diagrams to illustrate the similarities shared by all electromagnetic waves and differences between them. Show how wavelength is used to distinguish the different groups of EM waves (radio waves, microwaves, IR, visible and UV waves, X-rays and gamma waves). Conduct investigations involving moving objects to examine the influence that the mass and the speed have on the kinetic energy of the object. Collect and graph data that supports that the kinetic energy depends linearly upon the mass, but nonlinearly upon the speed. Recognize that the kinetic energy of an object depends on the square of its speed, and that $KE = \frac{1}{2} mv^2$.	Draw a schematic to illustrate a positive and negative feedback mechanism that regulates body systems in order to help maintain homeostasis. Describe how environmental factors (e.g., UV light or the presence of carcinogens or pathogens) alter cellular functions. ***Also in Standard 7:*** Describe the relationship between DNA, genes, chromosomes and proteins. Trace how a DNA sequence, through transcription and translation, results in a sequence of amino acids. Demonstrate that when DNA replicates, the complementary strands separate and the old strands serve as a template for the new complementary strands. Recognize that this results in two identical strands of DNA that are exact copies of the original. Illustrate how a sequence of DNA nucleotides codes for a specific sequence of amino acids.	Identify mid-sized nuclei as the most stable nuclei, and use the concept of stability to explain the basics of nuclear fission, fusion, and radioactive decay. Use models and diagrams to illustrate the differences between fission, fusion and radioactive decay. Use vector diagrams to illustrate how the total force is determined from a group of individual forces. Make vector diagrams of objects moving with a constant velocity, identifying all of the forces acting on the object (for example, a car moving along a straight highway, an aircraft in flight, an elevator ascending at constant speed, etc.). Reflect on how forces can collectively act on the object and not change its motion (basis of Newton's 1^{st} Law). Conduct investigations to reach qualitative and quantitative conclusions regarding the effects of the size of the total force and the object's mass on its resulting acceleration (Newton's 2^{nd} Law, $a = F_{totat}/m$). Observe how the direction of the acceleration relates to the direction of the total force.	Based on knowledge of populations and interactions in an ecosystem, predict the possible long-term outcomes (e.g., extinction, adaptation, succession) of a natural disaster on populations in the ecosystem. Explain the significance of the introduction of non-native and invasive species to a stable ecosystem and describe the consequent harm to the native species and the environment (e.g., zebra mussels, purple loosestrife, phragmites, Japanese Beetles). Describe how the biotic and abiotic factors can act as selective pressures on a population and can alter the diversity of the ecosystem over time. Identify limiting factors in an ecosystem and explain why these factors prevent populations from reaching biotic potential. Predict the effects on a population if these limiting factors were removed. Explain why a population reaching unlimited biotic potential can be detrimental to the ecosystem.

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Collect and graph data that shows that the potential energy of an object increases linearly with the weight of an object (mg) and with its height above a pre-defined reference level, h. (GPE = mgh) Conduct investigations and graph data that indicates that the energy stored in a stretched elastic material increases nonlinearly with the extent to which the material was stretched. Describe the differences between nuclear energy and chemical energy, that chemical energy is derived from the energy of the electrons that move around the nucleus, while nuclear energy is associated with the protons and neutrons in the nucleus. Recognize that electromagnetic waves transfer energy from one charged particle to another. Use graphics or computer animations to illustrate this transfer process. Give everyday examples of how society uses these transfer processes (for example, communication devices such as radios and cell phones).	Use Punnett squares, including dihybrid crosses, and pedigree charts to determine probabilities and patterns of inheritance (i.e., dominant/recessive, co-dominance, sex-linkage, multi-allele inheritance). Analyze a karyotype to determine chromosome numbers and pairs. Compare and contrast normal and abnormal karyotypes. Describe how exposure to radiation, chemicals and pathogens can increase mutations.Predict the possible consequences of a somatic cell mutation. Describe the cell cycle as an orderly process that results in new somatic cells that contain an exact copy of the DNA that make up the genes and chromosomes found in the parent somatic cells. Compare and contrast the processes of growth (cell division) and development (differentiation).	Use Newton's Second Law to calculate the acceleration of objects that are subject to common forces (for example, gravity, constant pushing or pulling forces and/or friction). Use vector diagrams to show how the direction of the acceleration (relative to the direction of the velocity) can be used to determine if the speed of the object will increase or decrease and if the direction of motion will change. Describe what the size of the acceleration of an object indicates about the object's motion (how quickly the object's velocity will change). Give examples of objects having large accelerations (motorcycles starting from rest, vehicles stopping abruptly, cars negotiating sharp curves) and objects having small accelerations (tractor trailers starting from rest, large ships slowing down, and vehicles traveling on long gradual curves on highways). Conduct investigations to show that the acceleration due to gravity is the same for all objects near the surface of the earth. Use graphical analysis to determine the	Determine the carrying capacity for a population in an ecosystem using graphical representations of population data. Describe how birth rate, death rate, emigration, and immigration contribute to a population's growth rate. Illustrate how elements on Earth cycle among the biotic and abiotic components of the biosphere. Analyze how an understanding of biomagnification has led to the regulation of chemical use and disposal.

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Use diagrams to illustrate how the motion of molecules when a mechanical wave passes through the substance is different from the motion associated with their random kinetic energies. Use diagrams or models to explain how mechanical waves can transport energy without transporting matter. Use examples to illustrate that near the surface of a planet or moon, the gravitational force acting on an object remains nearly constant. Recognize that on Earth, the object would have to be moved several hundred miles above the surface before the decrease in the force of gravity would become detectable. Conduct investigations to determine the behavior of elastic materials. Graph the data and identify the relationship between the extent of the stretch and the size of the elastic force (i.e., $F_{elastic} = kx$ where x = stretch). Describe the role that forces play when energy is transferred between interacting objects and explain how the amount of energy transferred can be calculated from measurable quantities.	Analyze natural selection simulations and use data generated from them to describe how environmentally favored traits are perpetuated over generations resulting in species survival, while less favorable traits decrease in frequency or may lead to extinction. Describe that evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organism. Discuss how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process. Recognize that a change in a species over time does not follow a set pattern or timeline. Compare and contrast the role of sexual selection to the role of natural selection on the evolutionary process. Predict possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, industrial pollution).	acceleration due to gravity from experimental data. Use algebraic relationships that relate the acceleration of an object to its speed and position to make predictions about the motion of objects as they move along straight and circular paths. Conduct investigations (or demonstrate) that under a variety of conditions when two objects collide they exert equal sized forces on each other. Use Newton's 2nd Law to explain why these two objects may react differently to equal sized forces. Use vector diagrams and Newton's 3rd Law to explain how a bathroom scale indirectly indicates your weight. Conduct investigations to determine the relationship between the force acting on an object and the change it produces in the object's momentum (i.e., the impulse). ($\Delta P = F_{avg} \cdot \Delta t$)	

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Identify that 'work' is the process by which a force transfers energy to an object, and use measured quantities to make calculations of the work done by forces (W = energy transferred = F·D). Conduct investigations to determine what factors influence whether a force transfers energy to an object or away from the object, and how the direction of the force (relative to the direction of motion) influences the quantity of energy transferred by the force. Use models and diagrams to illustrate the structure of the atom. Include information regarding the distribution of electric charge and mass in the atom. Identify the forces that are responsible for the stability of the atom, and which parts of the atom exert and feel these forces. Describe why it is significant that energy cannot be created (made) or destroyed (consumed) and identify that that this property of energy is referred to as the Law of the Conservation of Energy.		Use the concept of impulse ($I = F_{avg} \cdot \Delta t$) to make estimates of average forces when the change in an object's momentum is known. For example, explain why collision forces will be reduced when the barriers are flexible (increasing Δt decreases F_{avg}) or how the severity of the injury to a falling athlete will be influenced by the surface the athlete lands on (i.e. turf, hard ground, concrete, etc.). Recognize that momentum (like energy) is a conserved quantity and describe how this property of momentum makes it a useful tool in problem solving, especially problems involving collisions. Describe that forces transfer energy from one object to another through a process called 'work'. Explain how calculating the work done by a force helps us make qualitative and quantitative predictions regarding the motion of objects. Use mathematics, graphing calculators and/or graphing analysis programs to investigate the work done by individual forces.	

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Use energy chains to trace the flow of energy through physical systems. Indicate the source of the energy in each example and trace the energy until it leaves the system or adopts a form in the system that neither changes nor is transferred. Make qualitative estimates all the forms of the energy involved and reflect on the consequences of the energy transfers and transformations that take place. For example, trace the flow of the radiant energy carried by sunlight that strikes the roof of a home. Reflect on how the color of the roof (light vs. dark) will have an impact on the ability to heat and cool the house and possibly the functional lifetime of the roofing materials themselves. Use diagrams and energy chains to illustrate examples of the selective absorption of mechanical waves in natural phenomena and examples of how the selective absorption of mechanical waves is used to conduct investigations in medicine, industry and science (for example ultrasound imagery, detecting the epicenter of earthquakes, testing structures for defects, and conducting explorations of the earth's crust and mantle).		Describe how the concept of torque is used to explain (and calculate) the rotational effect that forces have when they act on objects. Conduct investigations to identify the factors that determine the torque produced by a force (Torque = force · lever distance). (For example, what conditions must be met to ensure that the sum of all torques acting on an object is zero, leaving the object in rotational equilibrium?) Use energy chains to trace the flow of energy through systems that involve both static and kinetic friction. Use diagrams to illustrate how the constructive and destructive interference of waves occurs. Give specific examples of how wave interference occurs in earth systems for both mechanical waves and electromagnetic waves. For example, in the case of mechanical waves, demonstrate regions of high volume (constructive interference) and low volume 'dead spots' (destructive interference) in the space surrounding	

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Investigate how radio waves, microwaves, infrared waves, visible waves and ultraviolet waves behave when they strike different substances. Record how effectively different materials reflect, absorb and transmit different kinds of EM waves. Draw conclusions based on this data and the physical properties of the substances (for example some substances absorb visible waves, but not radio waves). Other materials absorb UV waves, but not visible waves). Use energy chains to trace the flow of energy in a selective absorption process (for example sunburn, Greenhouse Effect, microwave cooking). Use energy chains to trace the flow of energy through systems involving sliding friction and air resistance (for example, the braking action in vehicles or bicycles or a vehicle rolling to rest). Research the factors that contribute to the energy efficiency of cars and trucks.		two speakers or consider the effect that wave interference has on the impact of seismic waves produced by earthquakes. In the case of EM waves, observe the colored patterns (fringes) on a soap bubble or in a thin layer of oil on a puddle of water. Describe how wave interference is used to create useful devices, such as noise cancellation devices (mechanical waves), window coatings to selectively transmit or reflect IR waves, diffraction gratings for spectroscopy, and lasers (EM waves). Use diagrams and energy chains to illustrate and explain the flow and transformations of energy that occur in fission and fusion processes and during radioactive decay. Use energy chains to describe the flow of energy in a nuclear-fueled electric power facility. Indicate the source of energy of the facility, how and where energy leaves the facility, and in which parts of the facility energy transformations take place.	

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Examine the role that the power of the engine, and the weight and physical size and shape of the vehicle have on the fuel efficiency of the vehicle. Identify and report on the sources of the fuels currently used by vehicles and alternative fuels being developed. ***Also in Standard 4:*** Describe how the Earth formed (using the Solar Nebular Theory) into a solid core, molten mantle, crust of solid rock composed of plates, and early atmosphere as a result of the densities of the elements. ***Also in Standard 5:*** Identify mineral specimens according to their chemical and physical properties. Mineral specimens include calcite, quartz, mica, feldspar, and hornblende. Properties include hardness (Moh's scale), streak, specific gravity, luster, cleavage, crystal shape, and color, and other properties that are useful for identification of specific minerals such as reaction with hydrochloric acid.		Compare and contrast the energy diagram of the nuclear-fueled power plant to a comparable energy diagram for a fossil-fueled electric power plant. Prepare a written report, a poster, or a computer-based presentation that explains the advantages and disadvantages of using fossil fuels, nuclear fuel and alternative energy sources to generate electrical energy.	

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Identify a few of the most common elements in the Earth's crust, oceans, and atmosphere and confirm their location on the periodic table (example: Si, O, C, N, H, Al). Compare the relative abundance of elements found in the Earth's crust, oceans, and atmosphere. Trace carbon as it cycles through the crust, ocean, and atmosphere. Classify and describe features that are used to distinguish between igneous, sedimentary, and metamorphic rocks. Describe energy sources, processes, and transformations of Earth materials as they progress through the rock cycle to form new sedimentary, metamorphic, and igneous rocks. Discuss how the cycling of rock is continuous. Describe how igneous rocks are formed. Classify igneous rocks according to crystal size and mineral assemblage. Identify sandstone, shale and limestone by their composition and texture. Explain how sandstone, shale, and limestone can be changed into the metamorphic rocks quartzite, slate, and marble.			

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Investigate the densities, composition, and relative age of continental (felsic) and oceanic (mafic) rocks. Explain why the continental crust, although thicker in most places, overlies oceanic crust. Use this information to explain why oceanic crust subducts below continental crust in convergent plate boundaries and explain the configuration of land masses and ocean basins. Identify volcanic products (lava, mudflow, pyroclastic projectiles, ash, gases) associated with various types of volcanoes and their eruptions. Describe the effect of these products on life and property. Explain how the products of volcanic activity influence both long-term and short-term changes in the Earth system. Describe how energy within the Earth's interior is released in the form of earthquake waves, and explain how these waves affect Earth's surface. Describe how earthquake energy is represented on seismograms and describe how these waves can be used to determine the origin and intensity of earthquakes.			

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Describe the effects on life and property from consequences of earthquake such as landslides, liquification, surface faulting and tsunamis. Cite ways these hazards can be minimized. Use models or computer simulations to demonstrate the processes and origin of landforms at diverging, converging and transform plate boundaries. Show on a map how plate tectonics, earthquakes, and volcanoes are spatially related. Investigate how thermal convection relates to movement of materials. Apply this knowledge in explaining the cause of movement of the Earth's plates. Research and describe evidence that supports the Theory of Plate Tectonics to include rock magnetism and the age of the sea floor.			

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Enduring Understanding: The development of technology and advancement in science influence and drive each other forward. ***Also in Standard 2:*** Research and report on a variety of manufactured goods and show how the chemical properties of the component materials were used to achieve the desired qualities. ***Also in Standard 5:*** Describe ways in which people use historical data, geologic maps, and technologies to minimize earthquake damage.	**Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.** ***Also in Standard 7:*** Investigate how the human ability to manipulate genetic material and reproductive processes can be applied to many areas of medicine, biology, and agriculture. Evaluate the risks and benefits of various ethical, social and legal scenarios that arise from this ability. Discuss examples of how genetic engineering technology can be applied in biology, agriculture and medicine in order to meet human wants and needs. Explain how developments in technology (e.g. gel electrophoresis) have been used to identify individuals based on DNA as well as to improve the ability to diagnose genetic diseases.	**Enduring Understanding: The development of technology and advancement in science influence and drive each other forward**	**Enduring Understanding: The development of technology and advancement in science influence and drive each other forward.** ***Also in Standard 4:*** Use library and internet resources to identify characteristics of the Earth which permit it to support life, and compare those characteristics to properties of other planets. Based on the research, debate the possibility of life on other planets. Discuss how technology (i.e., telescopes, computers, space probes, radio observatories) assists astronomers in discovering and investigating celestial bodies beyond the limits of our Solar System. ***Also In Standard 8:*** Examine and describe how social and biological factors influence the exponential growth of the human population (e.g., economic, cultural, age at reproduction, fertility rate, birth/death rate, and environmental factors). Examine and describe how the exponential growth of the human population has affected

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			the consumption of renewable and non-renewable resources. Evaluate decisions about the use of resources in one country and how these decisions can impact the diversity and stability of ecosystems globally. Analyze ways in which human activity (i.e., producing food, transporting materials, generating energy, disposing of waste, obtaining fresh water, or extracting natural resources) can affect ecosystems and the organisms within. Research and discuss ways in which humans use technology to reduce the negative impact of human activity on the environment. (e.g., phytoremediation, smokestack scrubbers). Describe how advances in technology can increase the carrying capacity of an ecosystem (i.e., advances in agricultural technology have led to increases in crop yields per acre).

Standard 1: Nature and Application of Science and Technology, Grade Level Expectations Grades 9-12

Essential Questions: What makes a question scientific? What constitutes evidence? When do you know you have enough evidence? Why is it necessary to justify and communicate an explanation? Essential Question: How do science and technology influence each other? Essential Questions: How have past scientific contributions influenced current scientific understanding of the world? What do we mean in science when we say that we stand on the shoulders of giants?			
Enduring Understanding: Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation. Enduring Understanding: The development of technology and advancement in science influence and drive each other forward. Enduring Understanding: Understanding past processes and contributions is essential in building scientific knowledge.			
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Enduring Understanding: **Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*	**Enduring Understanding:** **Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*	**Enduring Understanding:** **Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*	**Enduring Understanding:** **Understanding past processes and contributions is essential in building scientific knowledge.** *There are no grade level expectations for this understanding.*