

Norton City Schools Standards-Based Science Course of Study

FIFTH GRADE

NATURE OF SCIENCE-These scientific process skills should be integrated into the following grade level content units.

Science and Technology Standard (ST)

Scientific Inquiry Standard (SI)

Scientific Ways of Knowing Standard (SK)

3-5 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 3-5 program, the student will:</p> <p><u>Science and Technology</u></p> <ul style="list-style-type: none"> ★ Describe how technology affects human life. (ST-A) ★ Describe and illustrate the design process. (ST-B) <p><u>Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation. (SI-A) ★ Organize and evaluate observations, measurements and other data to formulate inferences and conclusions. (SI-B) ★ Develop, design and safely conduct scientific investigations and communicate the results. (SI-C) 	<p>By the end of Fifth Grade, the student will:</p> <p><u>Understanding Technology</u></p> <ul style="list-style-type: none"> ★ Investigate positive and negative impacts of human activity and technology on the environment. (ST-5-1) <p><u>Abilities To Do Technological Design</u></p> <ul style="list-style-type: none"> ★ Revise an existing design used to solve a problem based on peer review. (ST-5-2) ★ Explain how the solution to one problem may create other problems. (ST-5-3) <p><u>Doing Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Select and safely use the appropriate tools to collect data when conducting investigations and communicating findings to others (e.g., thermometers, timers, balances, spring scales, magnifiers, microscopes and other appropriate tools). (SI-5-1) ★ Evaluate observations and measurements made by other people and identify reasons for any discrepancies. (SI-5-2) ★ Use evidence and observations to explain and communicate the results of investigations. (SI-5-3) ★ Identify one or two variables in a simple experiment. (SI-5-4). ★ Identify potential hazards and/or precautions involved in an investigation. (SI-5-5) ★ Explain why results of an experiment are sometimes different (e.g., 	

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<p><u>Scientific Ways of Knowing</u></p> <ul style="list-style-type: none"> ★ Distinguish between fact and opinion and explain how ideas and conclusions change as new knowledge is gained. (SK-A) ★ Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions. (SK-B) ★ Explain the importance of keeping records of observations and investigations that are accurate and understandable. (SK-C) ★ Explain that men and women of diverse countries and cultures participate in careers in all fields of science. (SK-D) 	<p>because of unexpected differences in what is being investigated, unrealized differences in the methods used or in the circumstances in which the investigation was carried out, and because of errors in observations). (SI-5-6)</p> <p><u>Nature of Science</u></p> <ul style="list-style-type: none"> ★ Summarize how conclusions and ideas change as new knowledge is gained. (SK-5-1) ★ Develop descriptions, explanations and models using evidence to defend/support findings. (SK-5-2) ★ Explain why an experiment must be repeated by different people or at different times or places and yield consistent results before the results are accepted. (SK-5-3) ★ Identify how scientists use different kinds of ongoing investigations depending on the questions they are trying to answer (e.g., observations of things or events in nature, data collection and controlled experiments). (SK-5-4) <p><u>Ethical Practices</u></p> <ul style="list-style-type: none"> ★ Keep records of investigations and observations that are understandable weeks or months later. (SK-5-5) <p><u>Science and Society</u></p> <ul style="list-style-type: none"> ★ Identify a variety of scientific and technological work that people of all ages, backgrounds and groups perform. (SK-5-6) 	
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FIFTH GRADE

ENERGY: SOUND AND LIGHT

Physical Sciences Standard (PS)

3-5 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 3-5 program, the student will:</p> <p><u>Physical Sciences</u> ★ Describe the properties of light and sound energy. (PS-F)</p>	<p>By the end of Fifth Grade, the student will:</p> <p><u>Nature of Energy</u> ★ Explore and summarize observations of the transmission, bending (refraction) and reflection of light. (PS-5-5) ★ Describe and summarize observations of the transmission, reflection, and absorption of sound. (PS-5-6) ★ Describe that changing the rate of vibration can vary the pitch of a sound. (PS-5-7)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <p>Sound</p> <ul style="list-style-type: none"> • Produce a variety of sounds by banging, plucking or blowing a variety of objects. • Infer that the loudness of a sound relates directly to the amount of energy used in producing a sound. • Produce examples of high-pitched and low-pitched sounds (e.g., vibrating columns of air, etc.). • Demonstrate that fast vibrations cause high-pitched sounds and low-pitched sounds are caused by slow vibrations. • Explore the “Doppler Effect” (when a vibrating object approaches and then moves away, its pitch changes). • Explore resonance (i.e., when an object causes another object of the same natural frequency to vibrate). • Observe reflection and absorption of sound waves (e.g., in water, ultrasound, SONAR, acoustical tiles, carpet, drapes, etc.). 	<ul style="list-style-type: none"> • Enrichment-ear and eye, how we hear and see • Enrichment-optical illusions

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- Identify the characteristics and properties of sound waves (e.g., wavelength, amplitude, frequency, periods, compressions, hertz, pitch, etc.).
- Light**
- Compare and contrast transverse (light) waves and longitudinal (sound) waves.
 - Demonstrate that sound and light can be absorbed.
 - Determine that observing an object requires light to travel from a light source to an object and then travel from the object to the eye of the observer.
 - Experiment with shadows or pinhole images to verify that light travels in a straight line.
 - Conduct experiments to demonstrate that as light spreads out from its source, it decreases in intensity.
 - Identify examples of transparent, translucent, and opaque materials and describe how light is refracted differently through each type of material.
 - Explore objects through convex (converging) and concave (diverging) lenses to determine differences between the images.
 - Define operationally that when light is reflected, its angle of incidence is equal to its angle of reflection.
 - Recognize the relationship between wavelength and frequency (inversely related) and their relationship to wave speed (wave speed = wavelength x frequency).
 - Interpret the electromagnetic spectrum to determine relationships among frequency, wavelength, and kinds of rays (e.g., radio, T.V., microwaves, visible light, gamma, short-wave radio, x-rays, etc.).
 - Describe light and sound in quantitative (e.g., hertz, decibels, etc.) and qualitative measures (e.g., bright, dark, loud, etc.).
- Energy Transformation and Conservation (as related to Energy: Sound and Light)**
- Cite examples (situations) of various types of energy being conserved or transformed from one specific form to another.
 - Investigate how energy and matter are conserved in everyday situations.
 - Compare and contrast the five main forms of energy:
 - Electrical

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	<ul style="list-style-type: none">◦ Mechanical◦ Chemical◦ Thermal (Heat)◦ Nuclear	
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FIFTH GRADE

ENERGY: ELECTRICAL AND THERMAL

Physical Sciences Standard (PS)

3-5 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 3-5 program, the student will:</p> <p><u>Physical Sciences</u></p> <ul style="list-style-type: none"> ★ Summarize the way changes in temperature can be produced and thermal energy transferred. (PS-D) ★ Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces. (PS-E) 	<p>By the end of Fifth Grade, the student will:</p> <p><u>Nature of Energy</u></p> <ul style="list-style-type: none"> ★ Define temperature as the measure of thermal energy and describe the way it is measured. (PS-5-1) ★ Trace how thermal energy can transfer from one object to another by conduction. (PS-5-2) ★ Describe that electrical current in a circuit can produce thermal energy, light, sound and/or magnetic forces. (PS-5-3) ★ Trace how electrical current travels by creating a simple electric circuit that will light a bulb. (PS-5-4) ★ Describe how electric energy can be produced from a variety of sources (e.g., sun, wind, coal). (Introduction Before Sixth Grade-PS-6-7) <p><u>Sub-Objectives to Meet Indicators:</u></p> <p>Thermal Energy</p> <ul style="list-style-type: none"> • Explain the term heat and explore its relationship to the movement of particles of matter. • Differentiate between heat and temperature. • Compare the ways the temperature of an object can be raised (e.g., rubbing, burning, bending, cutting, etc.). • Describe how a warmer object can warm a cooler one by contact or at a distance through the three methods of heat transfer (conduction, convection, and radiation). • Explain how some materials conduct heat much better than others (e.g., 	

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	<p>metal, wood, glass, water, etc.) do.</p> <ul style="list-style-type: none">• Compare and contrast a variety of types of insulators (e.g., plastic, wood, glass, rubber, air, etc.). <p>Electricity and Electromagnetism</p> <ul style="list-style-type: none">• Identify the parts of an atom and their functions (electron, proton and neutron).• Describe how objects gain static charges (static electricity).• Construct, draw, and label open and closed circuits (e.g., battery, bulb and wire, etc.) with or without switches.• Identify solids and solutions as insulators and conductors.• Construct, draw, and label parallel and series circuits.• Distinguish between safe and unsafe practices when dealing with electricity.• Design and construct simple electrical devices (e.g., filament light bulbs, flashlights, sockets, motors, etc.).• Design and construct an electromagnet.• Analyze the environmental impact of electrical production and usage.• Create a list describing energy sources (solar, wind, biomass, propane, natural gas, petroleum, hydropower, nuclear, and geothermal) related to the production of electricity by generators. <p>Energy Transformation and Conservation (as related to Energy: Thermal and Electrical)</p> <ul style="list-style-type: none">• Cite examples (situations) of various types of energy being conserved or transformed from one specific form to another.• Investigate how energy and matter are conserved in everyday situations.• Compare and contrast the five main forms of energy:<ul style="list-style-type: none">◦ Electrical◦ Mechanical◦ Chemical◦ Thermal (Heat)◦ Nuclear	
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FIFTH GRADE

CYCLES OF THE EARTH, SUN AND MOON

Earth and Space Sciences Standard (ES)

3-5 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 3-5 program, the student will:</p> <p><u>Earth and Space Sciences</u> ★ Explain the characteristics, cycles and patterns involving Earth and its place in the Solar System. (ES-A)</p>	<p>By the end of Fifth Grade, the student will:</p> <p><u>The Universe</u> ★ Describe how night and day are caused by Earth’s rotation. (ES-5-1) ★ Explain that Earth is one of several planets to orbit the sun, and that the moon orbits Earth. (ES-5-2) ★ Describe the characteristics of Earth and its orbit about the sun (e.g., three-fourths of Earth’s surface covered by a layer of water [some of it frozen], the entire planet surrounded by a thin blanket of air, elliptical orbit, tilted axis and spherical planet). (ES-5-3) ★ Explain that stars are like the Sun, some being smaller and some larger, but so far away that they look like points of light. (ES-5-4)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Diagram arrangements of the earth, sun and moon that produce: <ul style="list-style-type: none"> ◦ Solar and lunar eclipses ◦ A new moon ◦ High and/or low tides ◦ Seasons ◦ Phases of the moon (crescent to full) • Infer the relationship between the: <ul style="list-style-type: none"> ◦ Earth’s tilt and the seasons ◦ Hemispherical location and seasonal temperatures or cycles (e.g., amount of sunlight, daylight savings time, changing daylight/darkness hours, etc.). • Describe the revolution of the earth around the sun and the moon around the earth. 	

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	<ul style="list-style-type: none">• Illustrate phases of the moon and describe their relationship to the moon's position near the earth.• Create models of the earth, sun and moon cycles and discuss the reinforcement of concepts or limitations of these models.	
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FIFTH GRADE

FOOD CHAINS AND FOOD WEBS

Earth and Space Sciences Standard (ES)

Life Sciences Standard (LS)

3-5 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 3-5 program, the student will:</p> <p><u>Earth and Space Sciences</u> ★ Describe Earth’s resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved. (ES-C)</p> <p><u>Life Sciences</u> ★ Analyze plant and animal structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive. (LS-B) ★ Compare changes in an organism’s ecosystem/habitat that affect its survival. (LS-C)</p>	<p>By the end of Fifth Grade, the student will:</p> <p><u>Earth Systems</u> ★ Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely. (ES-5-5) ★ Investigate ways Earth’s renewable resources (e.g., fresh water, air, wildlife and trees) can be maintained. (ES-5-6)</p> <p><u>Diversity and Interdependence of Life</u> ★ Describe the role of producers in the transfer of energy entering ecosystems as sunlight to chemical energy through photosynthesis. (LS-5-1) ★ Explain how almost all kinds of animals’ food can be traced back to plants. (LS-5-2) ★ Trace the organization of simple food chains and food webs (e.g., producers, herbivores, carnivores, omnivores and decomposers). (LS-5-3) ★ Summarize that organisms can survive only in ecosystems in which their needs can be met (e.g., food, water, shelter, air, carrying capacity and waste disposal). The world has different ecosystems and distinct ecosystems support the lives of different types of organisms. (LS-5-4) ★ Support how an organism’s patterns of behavior are related to the nature of that organism’s ecosystem, including the kinds and numbers of other organisms present, the availability of food and</p>	

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	<p>resources, and the changing physical characteristics of the ecosystem. (LS-5-5)</p> <p>★ Analyze how organisms, including humans, cause changes in their ecosystems and how these changes can be beneficial, neutral or detrimental (e.g., beaver ponds, earthworm burrows, grasshoppers eating plants, people planting and cutting trees and people introducing a new species). (LS-5-6)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> ● Identify ways in which living things meet their needs, including the following physical characteristics and behaviors by which organisms meet basic needs: <ul style="list-style-type: none"> ◦ Energy and/or nutrients for growth ◦ Water ◦ Shelter and protection or escape from other organisms ◦ Thermoregulation or reactions (e.g., migration, hibernation, etc.) to climate or other environmental stresses. ◦ Elimination of wastes ◦ Reproduction ◦ Growth and maturation ● Describe the physical and behavioral adaptations of plants and animals (e.g., camouflage, migration/hibernation/dormancy, protection from predators, types of teeth, types of beaks, types of claws/talons/webbed feet, seasonal change, etc.). ● Diagram and analyze food chains, food webs and energy pyramids to trace the energy transfer among organisms, beginning with photosynthesis. ● Identify and explain the roles and relationships of primary producers, producers, consumers, decomposers, predators, prey, parasites, hosts, and scavengers in the environment (e.g. owls as predators, worms as decomposers, plants as producers, etc.) in a food chain, food web, or small ecosystem. ● Identify the relative amount (most, least) of energy from producers that is available to an organism or group of organisms in a food chain, food web and energy pyramid. ● Interpret diagrams to recognize that arrows are drawn from organisms that are eaten to the organisms that eat them in illustrations of food chains and food webs (e.g., plants → mouse 	
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	<p>→owl→, etc.).</p> <ul style="list-style-type: none"> ● Account for the conservation of energy in living systems, as in simple physical systems, due to: <ul style="list-style-type: none"> ◦ Organisms lose energy as heat. ◦ Organisms gain energy, directly or indirectly, from the sun. ◦ Energy can be stored in chemical bonds and passed on as organisms consume food (e.g., photosynthesis, etc.). ◦ Energy is transformed every time energy is transferred. ● Identify processes in the carbon and nitrogen cycles: <ul style="list-style-type: none"> ◦ Respiration ◦ Photosynthesis ◦ Decomposition ● Describe organisms or pathways through which the carbon and nitrogen cycles take place. ● Compare and contrast physical or biological factors that affect the carbon and nitrogen cycles. ● Recognize relationships between where organisms get the nutrients or gases they need in the cycles and how they make them available to other organisms. ● Analyze the cycling of resources as “an accounting of things as they change form”, similar to the conservation of mass or energy. ● Predict what can account for changes in matter or the way resources can and cannot be recycled, including: <ul style="list-style-type: none"> ◦ Cycling of resources ◦ Plants’ importance to carbon, nitrogen and water cycling ◦ Environmental results of deforestation ● Investigate environmental changes and conditions, both natural and manmade that will result in adaptations of living things to avoid endangerment or extinction (e.g., paving, pollution, spraying, developing industries on farmland, insecticidal/pesticidal runoff, deforestation, land development, storms, forest fires, floods, responses to seasonal change, etc.). ● Describe how changing one component of a biological system affects others (e.g., food, water, shelter, space, etc.). 	
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