

Norton City Schools Standards-Based Science Course of Study

SIXTH 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 (SK)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p><u>Science and Technology</u></p> <ul style="list-style-type: none"> ★ Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life. (ST-A) ★ Design a solution or product taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety and aesthetics). (ST-B) <p><u>Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and 	<p>By the end of Sixth Grade, the student will:</p> <p><u>Understanding Technology</u></p> <ul style="list-style-type: none"> ★ Explain how technology influences the quality of life. (ST-6-1) ★ Explain how decisions about the use of products and systems can result in desirable or undesirable consequences (e.g., social and environmental). (ST-6-2) ★ Describe how automation (e.g., robots) has changed manufacturing including manual labor being replaced by highly-skilled jobs. (ST-6-3) ★ Explain how the usefulness of manufactured parts of an object depends on how well their properties allow them to fit and interact with other materials. (ST-6-4) <p><u>Abilities To Do Technological Design</u></p> <ul style="list-style-type: none"> ★ Design and build a product or create a solution to a problem given one constraint (e.g., limits of cost and time for design and production, supply of materials and environmental effects). (ST-6-5) <p><u>Doing Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Explain that there are not fixed procedures for guiding scientific investigations; however, the nature of an investigation determines the procedures needed. (SI-6-1) ★ Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. (SI-6-2) 	

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<p>appropriate tools. (SI-A)</p> <p>★ Analyze and interpret data from scientific investigations using appropriate mathematical skills in order to draw valid conclusions. (SI-B)</p> <p><u>Scientific Ways of Knowing</u></p> <p>★ Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description and explanation). (SK-A)</p> <p>★ Explain the importance of reproducibility and reduction of bias in scientific methods. (SK-B)</p> <p>★ Give examples of how thinking scientifically is helpful in daily life. (SK-C)</p>	<p>★ Distinguish between observation and inference. (SI-6-3)</p> <p>★ Explain that a single example can never prove that something is always correct, but sometimes a single example can disprove something. (SI-6-4)</p> <p><u>Nature of Science</u></p> <p>★ Identify that hypotheses are valuable even when they are not supported. (SK-6-1)</p> <p><u>Ethical Practices</u></p> <p>★ Describe why it is important to keep clear, thorough and accurate records. (SK-6-2)</p> <p><u>Science and Society</u></p> <p>★ Identify ways scientific thinking is helpful in a variety of everyday settings. (SK-6-3)</p> <p>★ Describe how the pursuit of scientific knowledge is beneficial for any career and for daily life. (SK-6-4)</p> <p>★ Research how men and women of all countries and cultures have contributed to the development of science. (SK-6-5)</p>	
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MATTER: CHEMICAL REACTIONS

Physical Sciences Standard (PS)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p><u>Physical Sciences</u></p> <p>★ Relate uses, properties and chemical processes to the behavior and/or arrangement of the small particles that compose matter. (PS-A)</p> <p>★ Describe that energy takes many forms, some forms represent kinetic energy and some forms represent potential energy; and during energy transformations the total amount of energy remains constant. (PS-D)</p>	<p>By the end of Sixth Grade, the student will:</p> <p><u>Nature of Matter</u></p> <p>★ Explain that equal volumes of different substances usually have different masses. (PS-6-1)</p> <p>★ Describe that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, burning). (PS-6-2)</p> <p>★ Describe that in a physical change (e.g., state, shape and size) the chemical properties of a substance remain unchanged. (PS-6-3)</p> <p>★ Describe that chemical and physical changes occur all around us (e.g., in the human body, cooking and industry). (PS-6-4)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> ● Identify information about an atom from the Periodic Table of Elements, including: <ul style="list-style-type: none"> ○ Name of the element ○ Symbol ○ Atomic number ○ Atomic mass ○ Metal/Nonmetal ○ Number of protons and neutrons ● Diagram an atom of an element using the Periodic Table of Elements. ● Describe various atomic models throughout history (e.g., electron cloud model, Bohr’s model, etc.). ● Compare and contrast elements, mixtures, and compounds. 	

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	<ul style="list-style-type: none"> ● Identify properties of matter, including: <ul style="list-style-type: none"> ○ Color ○ Temperature ○ Magnetic/Nonmagnetic ○ Size ○ Weight/Mass ○ Luster/Shininess ○ Shape ○ Texture ○ Float/Sink ○ Malleability/Flexibility ○ Density ● Describe the states of matter and model their molecular structure (e.g., lots of molecules moving slowly/solid, etc.). ● Create a list of characteristics of simple physical changes, including: <ul style="list-style-type: none"> ○ Observable change in size ○ Observable change in shape/configuration ○ Change in state of matter of a substance ○ Does not produce or become a new substance ○ Do not involve permanent changes in properties of a material ● Create a list of characteristics of simple chemical changes, including: <ul style="list-style-type: none"> ○ Difficult to reverse ○ Often give off heat on their own ○ Result in a permanent change in substances' properties ● Compare and contrast simple physical changes versus chemical changes. ● Identify examples of changes before and after an event to determine whether a change is chemical or physical (e.g., cold packs, heat packs, physical changes caused by water, chemical changes involving water and other elements, etc.). ● Measure and/or describe the rate or nature of physical and/or chemical changes that are taking place. ● Measure pH of acids and bases. ● Compare and contrast acids, bases, and salts. ● Conduct experiments to neutralize a substance from an acid to a base. ● Compare and contrast solutions, saturated solutions, and suspensions. 	
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	<p>Energy Transformation and Conservation (as related to Matter: Chemical Reactions)</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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SIXTH GRADE

ECOLOGY: MAN’S IMPACT ON THE ENVIRONMENT

Physical Sciences Standard (PS)

Life Sciences Standard (LS)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p><u>Physical Sciences</u> ★ Describe renewable and nonrenewable sources of energy (e.g., solar, wind, fossil fuels, biomass, hydroelectricity, geothermal and nuclear energy) and the management of these sources. (PS-C)</p> <p><u>Life Sciences</u> ★ Explain how energy entering the ecosystems as sunlight supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment. (LS-C) ★ Explain how extinction of a species occurs when the environment changes and its adaptive characteristics are</p>	<p>By the end of Sixth Grade, the student will:</p> <p><u>Nature of Energy</u> ★ Explain that the energy found in nonrenewable resources such as fossil fuels (e.g., oil, coal and natural gas) originally came from the sun and may renew slowly over millions of years. (PS-6-5) ★ Explain that energy derived from renewable resources such as wind and water is assumed to be available indefinitely. (PS-6-6) ★ Describe how electric energy can be produced from a variety of sources (e.g., sun, wind and coal). (PS-6-7) ★ Describe how renewable and nonrenewable energy resources can be managed (e.g., fossil fuels, trees and water). (PS-6-8)</p> <p><u>Diversity and Interdependence of Life</u> ★ Describe how organisms may interact with one another. (LS-6-8)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> ● Identify human actions that affect the environment (e.g., insect control, paving, exhaust systems, construction, deforestation, acid rain, CFC’s, pesticidal/insecticidal runoff, factory pollution, mining, etc.). ● Describe and analyze how human actions or activities can affect the earth’s ecosystems and its plant and animal species in terms of: <ul style="list-style-type: none"> ○ Air, water, and soil pollution ○ Conservation of natural resources, including preservation of land and species of plants and animals 	

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<p>insufficient to allow survival (as seen in evidence of the fossil record). (LS-D)</p>	<ul style="list-style-type: none"> ◦ Change or maintenance of habitats for particular plant or animal species ◦ Erosion ◦ Soil fertility ◦ Use and/or production of different forms of energy • Investigate the availability and use of natural resources and energy sources (i.e., solar, wind, biomass, propane, natural gas, petroleum, hydropower, nuclear, and geothermal). • Compare and contrast fossil fuels (i.e., coal, petroleum, natural gas, and propane). • Differentiate between renewable and nonrenewable resources and strategies for managing and conserving them. • Apply appropriate management strategies, such as conservation and recycling, for existing resource supplies. • Compare and contrast the trade-offs (risks and benefits) represented as humans act to consume and/or conserve natural resources, while differentiating this analysis from how social pressure and advertising may impact actions. 	
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PATTERNS IN ROCKS AND SOIL

Earth and Space Sciences Standard (ES)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p><u>Earth and Space Sciences</u> ★ Identify that the lithosphere contains rocks and minerals and that minerals make up rocks. Describe how rocks and minerals are formed and/or classified. (ES-D)</p>	<p>By the end of Sixth Grade, the student will:</p> <p><u>Earth Systems</u> ★ Describe the rock cycle and explain that there are sedimentary, igneous and metamorphic rocks that have distinct properties (e.g., color, texture) and are formed in different ways. (ES-6-1) ★ Explain that rocks are made of one or more minerals. (ES-6-2) ★ Identify minerals by their characteristic properties. (ES-6-3)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> ● Examine the properties of rocks and minerals, including: <ul style="list-style-type: none"> ○ Color ○ Texture ○ Smell ○ Luster ○ Transparency ○ Hardness ○ Shape ○ Reaction to magnets ○ Cleavage ● Identify the relative hardness of a mineral using scratch tests and Moh's Scale of Hardness. ● Describe in comparative terms (e.g., oldest, youngest, etc.) the age of disturbed or undisturbed rock layers. ● Compare and contrast characteristics and/or patterns caused by various natural phenomena (e.g., glaciers, earthquakes, rivers, wind, erosion) 	

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	<p>weathering etc.).</p> <ul style="list-style-type: none">• Identify land features from a contour map.• Analyze data about rock or soil types.• Create a dichotomous key to classify rocks as igneous, sedimentary or metamorphic according to the way they were formed.• Determine the water-holding capacities of a variety of rocks.• Summarize how the following factors affect the development of different soil types:<ul style="list-style-type: none">◦ Climate◦ Plants and animals◦ Land surface features◦ Time◦ Type of parent material (origin of soil)	
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NEWTON'S LAWS OF MOTION

Physical Sciences Standard (PS)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p>Physical Sciences</p> <p>★ Predict the influence of the motion of some objects on other objects. (Note: This is Sixth Grade Ohio Proficiency Learner Outcome, PS-6-7. It must be taught through the 2005-2006 school year.)</p> <p>★ Recognize the advantages and/or disadvantages to the user in the operation of simple technological devices. (Note: This is Sixth Grade Ohio Proficiency Learner Outcome, PS-6-6. It must be taught through the 2005-2006 school year.)</p>	<p>By the end of Sixth Grade, the student will:</p> <p>Sub-Objectives to Meet Indicators:</p> <ul style="list-style-type: none"> • Compare and contrast sources of potential and kinetic energy. • Conduct an experiment to demonstrate the change of energy from potential to kinetic and vice versa. • Observe that an object at rest or in uniform motion will remain at rest or in motion until an outside force acts on the object (Newton's First Law of Motion/Inertia). • Describe changes in the motion of an object when it experiences a force (e.g., gravity, friction, etc.). • Define operationally (through experimentation) that "force x mass = acceleration" (Newton's Second Law of Motion). • Define operationally (through experimentation) that when a force acts on an object, it changes the momentum of that object, and that this change is proportional to the applied force and to the time it acts upon the object (Newton's Second Law of Motion). • Describe examples of Newton's Third Law of Motion that indicate every action (force) is accompanied by an equal and opposite reaction (force). • Identify action and reaction forces given examples of objects in motion. • Predict the motion of objects thrown or released by people who are in motion. • Describe the apparent forces or impacts people can feel as a result of a change in an object's motion (e.g., elevator rides, boating in windy weather, etc.). 	

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	<ul style="list-style-type: none">• Recognize the following relationships related to motion:<ul style="list-style-type: none">◦ Things move only when something moves them.◦ Things keep moving until something stops them.◦ The harder something is pushed, the faster it goes.◦ The more massive something is, the harder it is to move. <p><u>Mechanical Advantage of Simple Machines</u></p> <ul style="list-style-type: none">• Recognize the mechanical advantage (ratio of the output force produced by a machine to applied input force) to the user in the operation of a variety of devices (e.g., using a ramp to slide a heavy box into a truck uses less force than picking a box straight up off the ground, etc.).• Compare and contrast mechanical advantages to disadvantages to the user in the operation of a variety of devices (e.g., using a ramp to slide a heavy box into a truck requires moving it a greater distance than picking a box straight up off the ground, etc.).• Identify simple technological devices, one-function devices that are real-life applications of the six basic simple machines, e.g.:<ul style="list-style-type: none">◦ Levers-pliers◦ Wedges-scissors◦ Pulleys-curtain rods◦ Wheels and axles-wheelbarrows◦ Inclined planes-ramps◦ Screws-screws• Conduct experiments to verify that simple machines do not reduce work but they commonly make action less effort for people.• Conduct experiments to indicate that when a machine is used and the effort gets easier, something else (e.g. speed, distance of the effort, etc.) is sacrificed.	
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HEREDITY: This unit **SHOULD NOT** be taught in districts where **LIFE SCIENCE** is the focus for seventh or eighth grade.

Life Sciences Standard (LS)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 6-8 program, the student will:</p> <p><u>Life Sciences</u></p> <ul style="list-style-type: none"> ★ Explain that the basic functions of organisms are carried out in cells and groups of specialized cells form tissues and organs; the combination of these cells make up multicellular organisms that have a variety of body plans and internal structures. (LS-A) ★ Describe the characteristics of an organism in terms of a combination of inherited traits and recognize reproduction as a characteristic of living organisms essential to the continuation of the species. (LS-B) 	<p>By the end of Sixth Grade, the student will:</p> <p><u>Characteristics and Structure of Life</u></p> <ul style="list-style-type: none"> ★ Explain that many of the basic functions of organisms are carried out by or within cells and are similar in all organisms. (LS-6-1) ★ Explain that multicellular organisms have a variety of specialized cells, tissues, organs and organ systems that perform specialized functions. (LS-6-2) ★ Identify how plant cells differ from animal cells (e.g., cell wall and chloroplasts). (LS-6-3) <p><u>Heredity</u></p> <ul style="list-style-type: none"> ★ Recognize that an individual organism does not live forever; therefore reproduction is necessary for the continuation of every species and traits are passed on to the next generation through reproduction. (LS-6-4) ★ Describe that in asexual reproduction all the inherited traits come from a single parent. (LS-6-5) ★ Describe that in sexual reproduction an egg and sperm unite and some traits come from each parent, so the offspring is never identical to either of its parents. (LS-6-6) ★ Recognize the likenesses between parents and offspring (e.g., eye color, flower color) are inherited. Other likenesses, such as table manners are learned. (LS-6-7) 	<ul style="list-style-type: none"> • NOTE: This unit should not be taught in districts where life science is the main content covered at seventh or eighth grade, which includes Barberton, Coventry, Green, Manchester, Mogadore, Norton, Pymatuning Valley, Revere, Springfield, Stow-Munroe Falls, and Twinsburg school districts. Tallmadge will be teaching this unit at sixth grade.

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	<p><u>Diversity and Interdependence of Life</u> ★ Describe how organisms may interact with one another. (LS-6-8)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none">• Explain how organisms are made of cells (i.e., many organisms are made of a single cell; others, including plants and animals, are made of many cells), which are the fundamental units of life, whose details are usually only visible through a microscope.• Identify different body tissues and organs and determine that they are made up of different kinds of cells (e.g., fat, smooth muscle, skeletal muscle, heart, intestine, etc.).• Explain that living organisms have distinct structures and body systems that serve specific functions in growth, survival, and reproduction (e.g., various body structures for walking, flying, or swimming).• Describe changes that occur during mitosis and meiosis.• List examples of physical traits.• List examples of human traits that are not based on physical appearance.• Distinguish between traits that are genetic and traits that are environmentally controlled.• Distinguish between dominant and recessive traits.• Describe Mendel’s experiments with pea plants.• Explain the difference between genotype and phenotype.• Discuss and describe human genetic disorders.	
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