

Norton City Schools Standards-Based Science Course of Study 2003

SEVENTH 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)

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 	<p>By the end of Seventh Grade, the student will:</p> <p><u>Understanding Technology</u></p> <ul style="list-style-type: none"> ★ Explain how needs, attitudes and values influence the direction of technological development in various cultures. (ST-7-1) ★ Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other. (ST-7-2) ★ Recognize that science can only answer some questions and technology can only solve some human problems. (ST-7-3) <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 two constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects). (ST-7-4) <p><u>Doing Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however it is not always possible to control all variables. (SI-7-1) ★ Identify simple independent and dependent variables. (SI-7-2) ★ Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific 	

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<p>considerations and 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). (SW-A)</p> <p>★ Explain the importance of reproducibility and reduction of bias in scientific methods. (SW-B)</p> <p>★ Give examples of how thinking scientifically is helpful in daily life. (SW-C)</p>	<p>investigations. (SI-7-3)</p> <p>★ Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations. (SI-7-4)</p> <p>★ Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data. (SI-7-5)</p> <p>★ Identify faulty reasoning and statements that go beyond the evidence or misinterpret the evidence. (SI-7-6)</p> <p>★ Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density). (SI-7-7)</p> <p><u>Ethical Practices</u></p> <p>★ Show that the reproducibility of results is essential to reduce bias in scientific investigations. (SW-7-1)</p> <p>★ Describe how repetition of an experiment may reduce bias. (SW-7-2)</p> <p><u>Science and Society</u></p> <p>★ Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism and openness). (SW-7-3)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Measure length, mass, temperature, density, weight, etc. in SI Units. 	
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EIGHTH 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)

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 Eighth Grade, the student will:</p> <p><u>Understanding Technology</u></p> <ul style="list-style-type: none"> ★ Examine how science and technology have advanced through the contributions of many different people, cultures and times in history. (ST-8-1) ★ Examine how choices regarding the use of technology are influenced by constraints caused by various unavoidable factors (e.g., geographic location, limited resources, social, political and economic considerations). (ST-8-2) <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 more than two constraints (e.g., limits of cost and time for design and production, supply of materials and environmental effects). (ST-8-3) ★ Evaluate the overall effectiveness of a product design or solution. (ST-8-4) <p><u>Doing Scientific Inquiry</u></p> <ul style="list-style-type: none"> ★ Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations. (SI-8-1) ★ Describe the concepts of sample size and control and explain how these affect scientific investigations. (SI-8-2) ★ Read, construct and interpret data in various forms produced by self 	

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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). (SW-A)</p> <p>★ Explain the importance of reproducibility and reduction of bias in scientific methods. (SW-B)</p> <p>★ Give examples of how thinking scientifically is helpful in daily life. (SW-C)</p>	<p>and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols). (SI-8-3)</p> <p>★ Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode). (SI-8-4)</p> <p><u>Nature of Science</u></p> <p>★ Identify the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance and importance). (SW-8-1)</p> <p><u>Ethical Practices</u></p> <p>★ Explain why it is important to examine data objectively and not let bias affect observations. (SW-8-2)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Measure length, mass, temperature, density, weight, etc. in SI Units. 	
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SEVENTH/EIGHTH GRADE

PLATE TECTONICS

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></p> <ul style="list-style-type: none"> ★ Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution). (ES-C) ★ Describe the processes that contribute to the continuous changing of Earth's surface (e.g., earthquakes, volcanic eruptions, erosion, mountain building and lithospheric plate movements). (ES-E) 	<p>By the end of the Seventh/Eighth Grade, the student will:</p> <p><u>Earth Systems</u></p> <ul style="list-style-type: none"> ★ Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air). (ES-7-1) ★ Describe the interior structure of Earth and Earth's crust as divided into tectonic plates riding on top of the slow moving currents of magma in the mantle. (ES-8-9) ★ Explain that most major geological events (e.g., earthquakes, volcanic eruptions, hot spots and mountain building) result from plate motion. (ES-8-10) ★ Use models to analyze the size and shape of Earth, its surface and its interior (e.g., globes, topographic maps, satellite images). (ES-8-11) ★ Explain that some processes involved in the rock cycle are directly related to thermal energy and forces in the mantle that drive plate motions. (ES-8-12) ★ Describe how landforms are created through a combination of destructive (e.g., weathering and erosion) and constructive processes (e.g., crustal deformation, volcanic eruptions and deposition of sediment). (ES-8-13) ★ Explain that folding, faulting and uplifting can rearrange the rock layers so the youngest is not always found on top. (ES-8-14) ★ Illustrate how the three primary types of plate boundaries (transform, divergent and convergent) cause different landforms (e.g., mountains, volcanoes and ocean trenches). (ES-8-15) 	

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	<p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none">• Compare and contrast convection currents in magma, air and water.• Analyze the theory of plate tectonics through investigation of the break-up of Pangaea.• Create a sketch or map of the stages of the break-up of Pangaea.• Investigate relationships between volcanoes and earthquakes to land formation and land deformation.• Make maps and diagrams of the various landforms (e.g., mountains, valleys, plateaus, etc.).• Make a sketch of the various layers of the earth.• Infer geological history from rocks.• Construct a model of the changes in the earth's surface resulting from glacial movement.• Compare and contrast the processes of plate tectonics (e.g., volcanism, earthquakes, rifting, mountain building, etc.).• Describe the effects of natural changes (e.g., earthquakes, volcanic eruptions, erosion, etc.) on human activities.• Implement maps, diagrams, and common situations to determine how earth-changing processes are reflected in the landforms of the earth's surface.	
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SEVENTH/EIGHTH GRADE

WEATHER AND CLIMATE

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> ★ Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution). (ES-C)</p>	<p>By the end of the Seventh/Eighth Grade, the student will:</p> <p><u>Earth Systems</u> ★ Explain the biogeochemical cycles which move materials between the lithosphere (land), hydrosphere (water) and atmosphere (air). (ES-7-1) ★ Explain that Earth’s capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the length of time involved (e.g., global warming). (ES-7-2) ★ Describe the water cycle and explain the transfer of energy between the atmosphere and hydrosphere. (ES-7-3) ★ Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life. (ES-7-4) ★ Make simple weather predictions based on the changing cloud types associated with frontal systems. (ES-7-5) ★ Determine how weather observations and measurements are combined to produce weather maps and that data for a specific location at one point in time can be displayed in a station model. (ES-7-6) ★ Read a weather map to interpret local, regional and national weather. (ES-7-7) ★ Describe how temperature and precipitation determine climatic zones</p>	

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	<p>(biomes) (e.g., desert, grasslands, forests, tundra and alpine). (ES-7-8)</p> <p>★ Describe the connection between the water cycle and weather-related phenomenon (e.g., tornadoes, floods, droughts and hurricanes). (ES-7-9)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none">• Diagram and illustrate earth cycles, including water and weather cycles.• Use maps to trace the flow of water through ocean currents.• Compare and contrast convection currents in land, water and air.• Create a sketch of the layers of the atmosphere.• Provided with the appropriate key, identify various kinds of clouds and their relationship to types of weather.• Given various weather maps, identify weather symbols and predict weather patterns.• Investigate various climates and discuss their differences.• Infer influences on climate and weather (e.g., climate or weather from landforms, etc.).	
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SEVENTH/EIGHTH GRADE

THE UNIVERSE

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></p> <ul style="list-style-type: none"> ★ Describe how the positions and motions of the objects in the universe cause predictable and cyclic events. (ES-A) ★ Explain that the universe is composed of vast amounts of matter, most of which is at incomprehensible distances and held together by gravitational force. Describe how the universe is studied by the use of equipment such as telescopes, probes, satellites and spacecraft. (ES-B) 	<p>By the end of the Seventh/Eighth Grade, the student will:</p> <p><u>The Universe</u></p> <ul style="list-style-type: none"> ★ Describe how objects in the Solar System are in regular and predictable motions that explain such phenomena as days, years, seasons, eclipses, tides and moon cycles. (ES-8-1) ★ Explain that gravitational force is the dominant force determining motions in the Solar System and in particular keeps the planets in orbit around the Sun. (ES-8-2) ★ Compare the orbits and composition of comets and asteroids with that of Earth. (ES-8-3) ★ Describe the effect that asteroids or meteoroids have when moving through space and sometimes entering planetary atmospheres (e.g., meteor-“shooting star” and meteorite). (ES-8-4) ★ Explain that the universe consists of billions of galaxies that are classified by shape. (ES-8-5) ★ Explain interstellar distances are measured in light years (e.g., the nearest star beyond the sun is 4.3 light years away). (ES-8-6) ★ Examine the life cycle of a star and predict the next likely stage of a star. (ES-8-7) ★ Name and describe tools used to study the universe (e.g., telescopes, probes, satellites and spacecraft). (ES-8-8) <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Demonstrate, through the use of models, distances among objects and their motions within the solar system. 	

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	<ul style="list-style-type: none">• Simulate sun, earth and moon phenomena and arrangements through models.• Recognize relationships among seasonal change, time, and the tilt of the earth's axis, time of rotation and revolution, and orbital shape.• Investigate daylight, sunrise, and sunset.• Describe the effects of the tilt of the earth's axis on seasons, climate, solstices, and equinoxes.• Observe and record the phases of the moon over time.• Use a model of the moon and earth to explain the effect of the moon on tidal patterns.• Illustrate and explain lunar and solar eclipses.	
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SEVENTH/EIGHTH GRADE HEREDITY

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) ★ Explain how extinction of a species occurs when the environment changes and its adaptive characteristics are 	<p>By the end of the Seventh/Eighth 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) ★ Investigate the great variety of body plans and internal structures found in multicellular organisms. (LS-7-1) <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) 	

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<p>insufficient to allow survival (as seen in evidence of the fossil record). (LS-D)</p>	<p>★ Describe that asexual reproduction limits the spread of detrimental characteristics through a species and allows for genetic continuity. (LS-8-1)</p> <p>★ Recognize that in sexual reproduction new combinations of traits are produced which may increase or decrease an organism’s chances for survival. (LS-8-2)</p> <p><u>Evolutionary Theory</u></p> <p>★ Investigate the great diversity among organisms. (LS-7-8)</p> <p>★ Explain how variations in structure, behavior or physiology allow some organisms to enhance their reproductive success and survival in a particular environment. (LS-8-3)</p> <p>★ Explain that diversity of species is developed through gradual processes over many generations (e.g., fossil record). (LS-8-4)</p> <p>★ Investigate how an organism adapted to a particular environment may become extinct if the environment, as shown by the fossil record, changes. (LS-8-5)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> ● Identify the cell as the basic unit of life. ● Observe cellular characteristics with a microscope. ● Identify and describe the levels of organization (i.e., cells, tissues, organs, and organ systems). ● Investigate how a cell takes in nutrients to provide energy for the cell to grow and reproduce (e.g., asexual reproduction, phases of mitosis, diffusion, osmosis, active transport, etc.). ● Compare and contrast how plants and animals accomplish basic life functions at various levels of organization, including: <ul style="list-style-type: none"> ○ Respiration ○ Reproduction ○ Growth and development ○ Energy use ○ Excretion ○ Circulation ○ Digestion ○ Photosynthesis 	
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	<ul style="list-style-type: none">• Create a model of the process of cellular division (mitosis).• Define operationally, through experimentation, the basic nature of DNA, chromosomes and genes.• Recognize relationships between the work of Gregor Mendel and the laws of genetics.• Compare and contrast dominant and recessive traits of an organism.• Describe the Law of Segregation (meiosis).• Compare and contrast the difference between phenotypes and genotypes.• Investigate the Law of Independent Assortment to predict the results of genetic crosses (e.g., probability activities, Punnett squares, pedigrees, etc.).• Recognize relationships in the process of natural selection and the• Describe changes in populations over time incorporating:<ul style="list-style-type: none">◦ Natural selection◦ Adaptation◦ Natural variation◦ Mutation◦ Relationships between species◦ Survival of the fittest species (e.g., Peppered Moth's change of color over time, etc.)◦ Extinction (e.g., dinosaurs, etc.)• Discuss ways in which genetic engineering has contributed to medicine and agriculture (e.g., cloning, engineered wheat and beans, stem cell research, etc.).	
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SEVENTH/EIGHTH GRADE

ECOSYSTEMS

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 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 insufficient to allow survival (as seen in evidence of the fossil record). (LS-D) 	<p>By the end of the Seventh/Eighth Grade, the student will:</p> <p><u>Earth Systems</u></p> <ul style="list-style-type: none"> ★ Explain that Earth’s capacity to absorb and recycle materials naturally (e.g., smoke, smog and sewage) can change the environmental quality depending on the length of time involved (e.g., global warming). (ES-7-2) ★ Analyze data on the availability of fresh water that is essential for life and for most industrial and agricultural processes. Describe how rivers, lakes and groundwater can be depleted or polluted becoming less hospitable to life and even becoming unavailable or unsuitable for life. (ES-7-4) ★ Describe how temperature and precipitation determine climatic zones (biomes) (e.g., desert, grasslands, forests, tundra and alpine). (ES-7-8) <p><u>Diversity and Interdependence of Life</u></p> <ul style="list-style-type: none"> ★ Investigate how organisms or populations may interact with one another through symbiotic relationships and how some species have become so adapted to each other that neither could survive without the other (e.g., predator-prey, parasitism, mutualism and commensalism). (LS-7-2) ★ Explain how the number of organisms an ecosystem can support depends on adequate biotic (living) resources (e.g., plants, animals) and abiotic (non-living) resources (e.g., light, water and soil). (LS-7-3) ★ Investigate how overpopulation impacts an ecosystem. (LS-7-4) ★ Explain that some environmental changes occur slowly while others 	

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	<p>occur rapidly (e.g., forest and pond succession, fires and decomposition). (LS-7-5)</p> <p>★ Summarize the ways that natural occurrences and human activity affect the transfer of energy in Earth’s ecosystems (e.g., fire, hurricanes, roads and oil spills). (LS-7-6)</p> <p>★ Explain that photosynthetic cells convert solar energy into chemical energy that is used to carry on life functions or is transferred to consumers and used to carry on their life functions. (LS-7-7)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Describe the process of photosynthesis. • Compare and contrast the differences among primary and secondary producers, consumers, and decomposers in food chains, food webs and energy pyramids. • Illustrate and label diagrams of land and water food webs. • Illustrate energy gain directly or indirectly from the sun, energy stored in chemical bonds in food, energy transformed as organisms consume food, and energy diminishing in usefulness when lost as heat. • Trace the energy transformation food chains, food webs, and energy pyramids, illustrating the way it is always conserved. • Compare and contrast living and nonliving environmental changes and their effects on ecosystems, including: <ul style="list-style-type: none"> ◦ Changes in biotic factors (rainfall, temperature, light availability, etc.) ◦ Weather catastrophes on the local or global scale, such as flood or drought ◦ Air, water and soil pollution ◦ Competition among species for resources ◦ Species introductions ◦ Biological magnification ◦ Extinction of species • Compare and contrast the many ways different organisms adapt for changing seasons and changing environments to meet basic biological needs. • Recognize relationships between human activities and the survival of species, including the competition among organisms for resources. 	
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Norton City Schools Standards-Based Science Course of Study 2003

SEVENTH/EIGHTH GRADE

WAVES

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>★ 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 the Seventh/Eighth Grade, the student will:</p> <p>Nature of Energy</p> <p>★ Investigate how matter can change forms but the total amount of matter remains constant. (PS-7-1)</p> <p>★ Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic). (PS-7-3)</p> <p>★ Explain how energy can change forms but the total amount of energy remains constant. (PS-7-4)</p> <p>★ Trace energy transformation in a simple closed system (e.g., a flashlight). (PS-7-5)</p> <p>★ Demonstrate that waves transfer energy. (PS-8-4)</p> <p>★ Demonstrate that vibrations in materials may produce waves that spread away from the source in all directions (e.g., earthquake waves and sound waves). (PS-8-5)</p> <p>Sub-Objectives to Meet Indicators:</p> <ul style="list-style-type: none"> • Compare and contrast the behavior and properties of electromagnetic (light) and mechanical (sound) waves. • Compare and contrast how different forms of wave energy are produced, transferred, and detected (i.e., the nature of wave motion). • Define operationally through experimentation: <ul style="list-style-type: none"> ◦ Frequency ◦ Pitch ◦ Wavelength ◦ Amplitude (loudness) 	

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	<ul style="list-style-type: none"> ◦ Speed ◦ Energy ◦ Refraction ◦ Reflection <ul style="list-style-type: none"> • Design experiments to demonstrate the interaction of waves with various phases of matter (i.e., solids, liquids, plasma, and gases). • Predict the path of reflected or refracted waves. • Demonstrate the relationship between frequency and pitch to the Doppler Effect. • Compare and contrast the risks and benefits of the use of electromagnetic (e.g., x-rays, microwaves, etc.) or sound waves in everyday settings. • Recognize relationships between light and sound and why we are able to see and hear. • Explore light and sound in everyday, relevant situations (e.g., simple optical devices, acoustical systems, wave in/on water music, noise, etc.). <p>Transformations of Energy (As Applied to Waves)</p> <ul style="list-style-type: none"> • Demonstrate, through experimentation, the transformation and conservation of various forms of energy, including heat, light, chemical, mechanical, and electrical energy. • Apply the Laws of Conservation of Matter and Energy to everyday situations. <p>Electricity (Supplemental/Enrichment ONLY!!!!)</p> <ul style="list-style-type: none"> • Identify electrostatic forces and show how they affect electric fields. • Demonstrate properties of static electricity and compare the three methods of producing electric charges. • Identify insulators and conductors. • Describe how electricity is related to natural phenomena (e.g., lightning). • Define electric current and its unit of measurement. • Compare and contrast the uses of direct current through wet and dry cells. • Measure voltage, resistance, and current in appropriate units and explain how they relate to Ohm's Law. • Compare and contrast DC and AC current. • Compare and contrast series and parallel circuits. • Identify the parts of circuits and their functions. • Explain the use and operation of fuses and circuit breakers. 	
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	<ul style="list-style-type: none">• Identify the properties of magnetism and magnetic poles.• Demonstrate the behavior of compasses.• Map and identify the appearance and use of magnetic lines of force.• Compare and contrast permanent and temporary magnets.• Distinguish between geologic and magnetic poles.• Recognize the relationship between the earth's magnetic field and the phenomena of the Aurora Borealis.• Demonstrate Ormsted's experiments on electric currents and magnetic fields.• Investigate structures and uses of electric motors.• Investigate Faraday's and Henry's experiments in electromagnetism.• Identify the structure, operation, and uses of a generator.• Explain the production of AC current.• Compare and contrast step-up and step-down transformers.	
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SEVENTH/EIGHTH GRADE

FORCES AND 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><u>Physical Sciences</u></p> <ul style="list-style-type: none"> ★ In simple cases, describe the motion of objects and conceptually describe the effects of forces on an object. (PS-B) ★ 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>By the end of the Seventh/Eighth Grade, the student will:</p> <p><u>Nature of Energy</u></p> <ul style="list-style-type: none"> ★ Investigate how matter can change forms but the total amount of matter remains constant. (PS-7-1) ★ Describe how an object can have potential energy due to its position or chemical composition and can have kinetic energy due to its motion. (PS-7-2) ★ Identify different forms of energy (e.g., electrical, mechanical, chemical, thermal, nuclear, radiant and acoustic). (PS-7-3) ★ Explain how energy can change forms but the total amount of energy remains constant. (PS-7-4) ★ Trace energy transformation in a simple closed system (e.g., a flashlight). (PS-7-5) <p><u>Forces and Motion</u></p> <ul style="list-style-type: none"> ★ Describe how the change in the position (motion) of an object is always judged and described in comparison to a reference point. (PS-8-1) ★ Explain that motion describes the change in the position of an object (characterized by a speed and direction) as time changes. (PS-8-2) ★ Explain that an unbalanced force acting on an object changes that object's speed and/or direction. (PS-8-3) <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Distinguish between speed and velocity. 	

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	<ul style="list-style-type: none">• Interpret a distance over time graph.• Compare and contrast acceleration and deceleration.• Recognize the relationship between velocity and mass to calculate momentum.• Define operationally (through experimentation) Newton's Laws of Motion:<ul style="list-style-type: none">◦ 1st Law – A body at rest will remain at rest unless an unbalanced force acts on it. A body in motion will remain in motion and in a straight line at a steady speed unless an unbalanced force acts on it.◦ 2nd Law – When an unbalanced force acts on a mass, it produces an acceleration in the direction of the force that is directly proportional to the force and inversely proportional to the mass ($F = ma$).◦ 3rd Law – If one object applies a force to another, the second object applies an equal and opposite force to the first object. For every action there is an equal and opposite reaction.• Discuss the development of the Universal Gravitational Law: Objects will fall at 9.8 meters/second squared.• Predict the effects of change in friction, gravity, magnetic field, and other forces on objects. <p>Fluid Forces</p> <ul style="list-style-type: none">• Investigate the effects of air resistance on falling objects (e.g., terminal velocity, etc.).• Demonstrate the Archimedes Principle as it relates to buoyancy.• Investigate Bernoulli's Principle as it applies to flight. <p>Transformations of Energy (as Applied to Forces and Motion)</p> <ul style="list-style-type: none">• Infer the relationship between friction and heat.• Demonstrate, through experimentation, the transformation and conservation of various forms of energy including heat, light, chemical, mechanical, and electrical energy.• Apply the Laws of Conservation of Matter and Energy to everyday situations. <p>Simple Machines (Supplemental/Enrichment ONLY!!!!)</p> <ul style="list-style-type: none">• Describe how energy is transferred or conserved during motion as it	
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	<p>applies to force, momentum, power, and work.</p> <ul style="list-style-type: none">• Describe changes in the effort and distance through which work is done by the following simple machines:<ul style="list-style-type: none">◦ Levers◦ Pulleys◦ Inclined planes◦ Wedges◦ Wheels and axles◦ Screws• Explore the concept of work in terms of force and distance.• Identify machines as a way to make work easier.• Calculate the relationship between efficiency and mechanical advantage• Compare and contrast the advantages and disadvantages of simple technological devices and their functions in everyday, relevant contexts.• Illustrate, diagram, and chart the application of simple machines to practical situations.	
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EIGHTH GRADE

CONCEPTS OF CHEMISTRY: This unit addresses content from the ninth grade physical science standards. This supplemental unit may be taught at the end of the eighth grade year in districts where PHYSICAL SCIENCE is the focus for eighth grade.

Physical Sciences Standard (PS)

6-8 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 9-10 program, the student will:</p> <p><u>Physical Sciences</u></p> <ul style="list-style-type: none"> ★ Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms. (PS-A) ★ Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances. (PS-B) ★ Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties 	<p>By the end of the Eighth Grade, the student will:</p> <p><u>Nature of Matter</u></p> <ul style="list-style-type: none"> ★ Recognize that all atoms of the same element contain the same number of protons, and elements with the same number of protons may or may not have the same mass. Those with different masses (different numbers of neutrons) are called isotopes. (PS-9-1) ★ Illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral. (PS-9-2) ★ Show that when elements are listed in order according to the number of protons (called the atomic number), the repeating patterns of physical and chemical properties identify families of elements. Recognize that the periodic table was formed as a result of the repeating pattern of electron configurations. (PS-9-4) ★ Describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons. (PS-9-5) ★ Explain that the electric force between the nucleus and the electrons hold an atom together. Relate that on a larger scale, electric forces hold solid and liquid materials together (e.g., salt crystals and water). (PS-9-6) ★ Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of 	

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<p>can occur without changing the chemical nature of the substance. (PS-C)</p> <p>★ Demonstrate that energy can be considered to be either kinetic (motion) or potential (stored). (PS-E)</p> <p>★ Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (PS-F)</p>	<p>atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations). (PS-9-7)</p> <p>★ Demonstrate that the pH scale (0-14) is used to measure acidity and classify solutions as acidic, basic, or neutral substances. (PS-9-8)</p> <p><u>Nature of Energy</u></p> <p>★ Explain how thermal energy exists in the random motion and vibrations of atoms and molecules. Recognize that the higher the temperature, the greater the average atomic or molecular motion, and during changes of state the temperature remains constant. (PS-9-11)</p> <p>★ Illustrate that chemical reactions are either endothermic or exothermic (e.g., cold packs, hot packs and the burning of fossil fuels). (PS-9-16)</p> <p>★ Demonstrate that thermal energy can be transferred by conduction, convection or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation). (PS-9-17)</p> <p><u>Sub-Objectives to Meet Indicators:</u></p> <ul style="list-style-type: none"> • Identify general properties of matter (e.g., size, shape, color, etc.). • Investigate physical properties of matter (e.g., density, inertia, melting point, etc.). • Compare and contrast chemical and physical properties (e.g., density, etc.). • Identify the four phases of matter (solids, liquids, gases, and plasma). • Explain Boyle's and Charles' Laws: <ul style="list-style-type: none"> ◦ Boyle's Law-The volume of a certain amount of gas is inversely proportional to the pressure, if the temperature remains constant. ◦ Charles' Law-Gases increase or decrease their volume as the temperature rises and falls, provided pressure and amount of gas are held constant. • Recognize relationships involving the Periodic Table of Elements (e.g., atomic numbers, metals and non-metals, simple bonding, etc.). • Compare and contrast differences in various atomic theories. • Model atomic structures and identify subatomic particles (neutrons, 	
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	<p>protons, electrons, quarks).</p> <ul style="list-style-type: none">• Describe the concepts of atomic number, atomic mass, and valence.• Create diagrams or models of atomic and molecular structure, including simple bonding.• Investigate the historical development of the Periodic Table of Elements. <p>Physical and Chemical Changes</p> <ul style="list-style-type: none">• Differentiate compounds from mixtures.• Differentiate properties of acids and bases by using indicators and measuring pH.• Investigate the solubility of solutions (dilute, saturated, and supersaturated).• Investigate simple physical changes to determine characteristics of them (change in size, change in phase, change in mass, do not result in irreversible changes in properties of matter).• Investigate simple chemical changes to determine characteristics of them (difficult to reverse, usually result in a change in the properties of the material, often give off or absorb heat).• Describe simple chemical bonding in terms of atom electron arrangement and energy levels.• Write simple chemical formulas and balance simple chemical equations. <p>Transformations of Energy (As Applied to Concepts of Chemistry)</p> <ul style="list-style-type: none">• Investigate endothermic and exothermic processes.• Recognize relationships between freezing, melting, and boiling points (e.g., heat of fusion, heat of vaporization, phase changes, etc.).• Identify examples of heat transfer, including insulation, conduction, and convection.• Demonstrate, through experimentation, the transformation and conservation of various forms of energy, including heat, light, chemical, mechanical, and electrical energy.• Apply the Laws of Conservation of Matter and Energy to everyday situations.	
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