

Science Curriculum

Strand I. Constructing New Scientific Knowledge

Grade: High School

Standard	Standard I.1 Constructing New Scientific Knowledge All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge.
Benchmarks	All students will ask questions that help them learn about the world: I.1.1. Ask questions that can be investigated empirically <i>Key concepts:</i> Questions often build on existing knowledge <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Determine causative agents of disease• Formulate a hypothesis based upon scientific observations• Design an experiment to test a hypothesis• Complete any online science Web quest activity• Explore chicken embryo development via using MRI• Complete “The True Witness” forensic science exploration by applying knowledge of biological, physical and chemical sciences• Research and complete a science fair project

Resources

- Embryonic Chicken development with chicscope = <http://chickscope.beckman.uiuc.edu>
- Science Fair Resource Guide = <http://www.ipl.org/div/kidspace/projectguide/>
- The True Witness = <http://library.thinkquest.org/17049/gather/index.en.shtml>

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<p>Benchmarks</p>	<p>All students will design and conduct investigations using appropriate methodology and technology: I.1.2. Design and conduct scientific investigations. <i>Key concepts:</i> Types of scientific knowledge- hypothesis, theory, observation, conclusion, law, data, generalization. Aspects of field research- hypothesis, design, observations, samples, analysis, conclusion. Aspects of experimental research- hypothesis, design, variable, experimental group, control group, prediction, analysis, conclusion. Investigations are based on questions about the world (see C-I.1 h.1). <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge benchmarks for which students would design and/or conduct investigations</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Formulate a hypothesis based upon scientific observations • Define and identify variables • Design an experiment to test a hypothesis • Analyze data via comparative studies, mathematical calculations and graphing techniques • Form conclusions based upon collected quantitative and qualitative data • Identify experimental sources of error • Prepare a science project for a science fair • Prepare formal laboratory reports post scientific experiment • Investigate the effectiveness of household cleaners on bacterial growth
<p>Resources</p>	<ul style="list-style-type: none"> • Barbie Doll Crash Dummies laboratory investigation • Potatoes in Solutions Laboratory Investigation • Interdisciplinary lesson on Climate & Weather = http://www.remc11.k12.mi.us/bstpract/bstpract/083/083.pdf • Plan and build a dam in Civil Engineering Web Quest = http://simscience.org/cracks/

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Benchmarks	All students will design and conduct investigations using appropriate methodology and technology: I.1.3. Recognize and explain the limitations of measuring devices. <i>Key concepts:</i> Uncertainty, error, range, tolerances, accuracy, precision. <i>Tools:</i> Balance, thermometer, measuring tape, ruler, graduated cylinder, electronic measuring devices. <i>Real-world contexts:</i> Experiments that use quantitative data; manufacturing systems where measurements are critical.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Utilize appropriate technology in researching, gathering data, and in communicating scientific results• Identify sources of possible error in scientific studies• Complete Accuracy & Precision Laboratory Investigation• Prepare formal laboratory reports post experimental completion• Correctly utilize scientific laboratory equipment within classroom
Resources	<ul style="list-style-type: none">• Safety in Science laboratories = http://www.flinnsci.com/sections/safety/safety.asp.

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Benchmarks	All students will design and conduct investigations using appropriate methodology and technology: I.1.4.Gather and synthesize information from books and other sources of information. <i>Key concepts:</i> Scientific journals, text-and computer-based reference materials. <i>Real-world contexts:</i> Libraries, technical reference books, Internet, computer software.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Write a research paper on a selected scientific topic. Include set requirements for inclusion of scientific journals, texts, computer or on-line resources.• Prepare a science project for a science fair• Complete any online science Web quest activity• Complete weekly CES (Current Event in Science Summary)
Resources	

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Benchmarks	All students will learn from books and other sources of information: I.1.5. Discuss topics in groups by making clear presentations, restating or summarizing what others have said, asking for clarification or elaboration, taking alternative perspectives, and defending a position. <i>Key concepts:</i> Logical argument, summary, clarification, elaboration, alternative perspectives. scientific information, such as figures, tables, graphs. See R-II.1 m.1 (evaluate strengths/weaknesses of claims). <i>Real-world contexts:</i> Newspaper or magazine articles discussing a topic of social concern.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Design a power-point presentation on a scientific topic• Prepare a science project for a science fair• Prepare formal laboratory reports post scientific experiment• Complete a weekly science current event summary
Resources	

Science Curriculum

Strand II. Reflecting on Scientific Knowledge

Grade: High School

Standard	Standard II.1 Reflecting on Scientific Knowledge All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science.
Benchmarks	All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge: II.1.1. Justify plans or explanations on a theoretical or empirical basis. <i>Key concepts:</i> Aspects of logical argument; including evidence, fact, opinion, assumptions, claims, conclusions, observations. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge
Sample Activity/Assessment tasks	
Resources	

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Benchmarks	All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge: II.1.2. Describe some general limitations of scientific knowledge. <i>Key concepts:</i> Understanding of the general limits of science and scientific knowledge as constantly developing human enterprises; recognizing that arguments can have emotive, economic, and political dimensions as well as scientific. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.
Sample Activity/Assessment tasks	
Resources	

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Benchmarks	All students will show how science is related to other ways of knowing: II.1.3. Show how common themes of science, mathematics, and technology apply in real-world contexts. <i>Thematic ideas:</i> Systems-subsystems, feedback models, mathematical constancy, scale, conservation, structure, function, adaptation. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Complete a weekly science current event summary
Resources	

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Benchmarks	All students will show how science and technology affect our society: II.1.4. Discuss the historical development of key scientific concepts and principles. <i>Key concepts:</i> Historical, political, social, and economic factors influencing the development of science. See <i>Benchmarks for Science Literacy</i> , AAAS, Chapter 10. <i>Real-world contexts:</i> Technological systems for manufacturing, transportation, energy distribution, housing, medicine (such as cloning, genetic engineering).
Sample Activity/Assessment tasks	
Resources	

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Benchmarks	All students will show how science and technology affect our society: II.1.5. Explain the social and economic advantages and risks of new technology. <i>Key concepts:</i> Cost-benefit analysis; See LO h.5. (Health technology), PME-IV.1 h.1 (household and agricultural materials, EG-V.1 h.4 (resource use), LEC-III.5 h.6 (effects of urban development and agriculture on ecosystems), EAW-V.3 h.4 (air pollution), EH-V.2 h.2 (water pollution). <i>Real-world contexts:</i> Issues related to new technologies, including ones in health-care, transportation, communications, manufacturing, information and media.
Sample Activity/Assessment tasks	

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Benchmarks	All students will show how science and technology affect our society: II.1.6. Develop an awareness of and sensitivity to the natural world <i>Key concepts:</i> Appreciation of the balance of nature and the effects organisms have on each other, including the effects humans have on the natural world. <i>Real-world contexts:</i> Any in the sections on Using Scientific Knowledge appropriate to highschool
Sample Activity/Assessment tasks	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

<p>Standard</p>	<p>Standard III.1 Cells All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce.</p>
<p>Benchmarks</p>	<p>All students will apply an understanding of cells to the functioning of multicellular organisms, including how cells grow, develop and reproduce: (Demonstrate evidence that all parts of living things are made of cells.) III.1.1 Explain how multi-cellular organisms grow, based on how cells grow and reproduce. <i>Key concepts:</i> Specialized functions of cells- respiration (see LO h.3), protein synthesis, mitosis, meiosis (see LH-III.3 h.2). Basic molecules for cell growth – simple sugars, amino acids, fatty acids. Basic chemicals, molecules and atoms-water, minerals, carbohydrates, proteins, fats and lipids, nucleic acids; carbon, hydrogen, oxygen, nitrogen. Cells come only from other cells. See LO m.4 (digestion). <i>Real-world contexts:</i> The growth of plants and animals</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Explain the relationship between atoms, elements, compounds and molecules • Discuss atomic structure and how the electron shells of an atom can influence its ability to react with atoms • Compare and contrast covalent, ionic and hydrogen bonds. • Explain why an understanding of basic chemistry is important in the study of life processes • Explain the role of chemistry in life processes (digestion, circulation, respiration, metabolism, communication etc.) • List and describe the basic types of chemical reactions (synthesis, decomposition, exchange) that occur within living organisms • Categorize elements as major or trace within the human body • Discuss the properties of water that make it an integral inorganic molecule within living organisms • Identify the four major macromolecule groups in the body and explain the function of each • Discuss the concept of pH and its relationship to life processes • Explain the role of enzymes in living organisms • Analyze graphs comparing enzyme activity and temperature • Compare and contrast anabolism, catabolism and metabolism • Identify the components of the cell theory and explain how it was developed • Draw and label the phases and parts of the mitotic cycle • Compare and contrast the processes of mitosis and meiosis • Perform pH Inquiry Investigation

Resources	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.1 Cells All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce.
Benchmarks	All students will apply an understanding of cells to the functioning of multicellular organisms, including how cells grow, develop and reproduce: (Explain why and how selected specialized cells are needed by plants and animals). III.1.2. Compare and contrast ways in which selected cells are specialized to carry out particular life functions <i>Key concepts:</i> Classifications of organisms by cell type-plant, animal, bacteria; selected specialized plant and animal cells-red blood cells, white blood cells, muscle cells, nerve cells, root cells, leaf cells, stem cells; cell parts used for classification- organelle, nucleus, cell wall, cell membrane; specialized functions-reproduction (see LC-III.1 h.1, LH-III.3 h.2), photosynthesis (see LO m.3), transport; cell shape. <i>Tools:</i> microscopes <i>Real-world contexts:</i> Reproduction, growth, response, movement, ect. Of animals and plants. Functions of bacteria.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Describe the molecular structure and functions of cellular membranes• Explain the fluid mosaic model of the cell membrane• Discuss the structure and function of cellular components• Label, describe and list the functions of the following cellular organelles: ribosomes, endoplasmic reticulum, nucleus, peroxisomes, mitochondria, lysosomes, Golgi Apparatus, centrosomes, and cytoskeleton• Compare and contrast diffusion, facilitated diffusion, dialysis, osmosis, filtration• Differentiate between active transport mechanisms of endocytosis, exocytosis, pinocytosis, and phagocytosis• Identify and analyze cells by completing microscope cell labs• Complete online cell organelle quizzes• Compare and contrast plant and animal cells• Explain how cell functions are controlled to allow a living organism to respond to the environment• Construct a 3-D model of a plant or animal cell and present to class• Complete an “Interactive Tour of the Cell Web Quest”• View Virtual Cell Online Tour

- Utilize microscopes to view and measure different types of cells (animal/plant;prokaryotic/eukaryotic)
- Perform Rate of Diffusion Experiments as in Agar Block and Dialysis Tubing Activities
- Perform Enzyme Inquiry Lab Activities 1-6
- Complete the research on bacteria reproduction project

Resources

- Tour of Cell Web Quest =
- Virtual Cell Online= <http://www.ibiblio.org/virtualcell/index.htm>
- Online Cell Quizzes= <http://www.quia.com/custom/2744main.html>
- <http://biology.arizona.edu/sciconn/lessons/mccandless/default.html>

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.2 The Organization of Living Things All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions.
Benchmarks	All students will use classification systems to describe groups of living things: III.2.1. Classify major groups of organisms to the kingdom level. <i>Key concepts:</i> Kingdom categories- protist, fungi, moneran, animal, plant. Characteristics for classification- cell wall, cell membrane, organelle, single-celled, multicellular. <i>Real-world contexts:</i> Common local representatives of each of the five major kingdoms- Paramecium, yeast, mushroom, bacteria, frog, geranium
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Compare and contrast prokaryotic and eukaryotic cells• Observe examples of prokaryotic/eukaryotic cells with the microscope• Compare and contrast the structure of animals, plants, fungi, protists and monerans• Compare modern-day life forms with those found in fossil records• Construct a taxonomic key for a set of items• Utilize a taxonomic key for identification of specimens for a student collection project (i.e. leaves/insects)• Compare and contrast structural similarities among three arthropods: crayfish, spider and grasshopper via dissection in laboratory• Complete Microbe Detective online• Cite characteristics of each kingdom• Identify the distinguishing characteristics of Animalia (chordate, arthropoda, annelida, mollusca, porifera, and cnidaria)• Identify the distinguishing characteristics of Plantae (mosses, ferns, gymnosperms, and angiosperms)• Complete Animal Kingdom Diversity Activity• Complete comparative dissections of representative organisms within the Animalia Kingdom

Resources

- Microbe Detective: <http://scorescience.humboldt.k12.ca.us/fact/teachers/microbemia/index.htm>
- Virtual Zoo site= <http://www.naturalia.org/zoo/indexing.html>
- Microbial zoo site= <http://commtechlab.msu.edu/sites/dlc-me/zoo/>

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Benchmarks	All students will compare and contrast differences in the life cycles of living things: III.2.2. Describe the life cycle of organism(s) associated with human disease(s). <i>Key concepts:</i> Infection process-disease, parasite, carrier, host, infection. <i>Tools:</i> Microscope, hand lens. <i>Real-world contexts:</i> Life cycle of organism(s) associated with human disease(s), such as Lyme disease-tick, malaria-mosquito, parasites.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Research Bioterror information on biowarfare, future germ defenses, bioweapons and vaccines• Present a powerpoint presentation on an infectious disease• Explain the lifecycle of a parasitic agent
Resources	

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Strand III. Using Scientific Knowledge in Life Science

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Benchmarks	All students will investigate and explain how living things obtain and use energy: III.2.3. Explain the process of food storage and food use in organisms <i>Key concepts:</i> Cellular respiration, photosynthesis (see LO m.3), oxygen, sunlight, carbon dioxide, carbohydrate, fat, protein, minerals, water. See LC-III.1 h.1 (how organisms grow), LO-III.2 m.3 (how plants store food) LO-III.2 m.4 (how food and oxygen are distributed to cells), LEC-III.5 m.2 (the sun as the ultimate source of energy for organisms) and PCM-IV.2 m.3 (energy transformations). <i>Real-world contexts:</i> Food storage, such as maple tree-maple sap, potato-starch, honey bee-honey, cow-beef, milk. Weight gain and loss. Change in respiration rates with exercise.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Describe early experiments that provided the basic facts about the processes of photosynthesis• Explain what happens when a pigment absorbs light• Draw a chloroplast and label its parts• Complete Photosynthesis webquest• Identify the different photosynthetic pigments in green leaves by completing Chromatography of Plant Pigments Experiment• Write out the general equation for photosynthesis• Compare and contrast the light and dark reactions of photosynthesis• List environmental conditions that will affect the photosynthetic rate and explain how they do• Compare and contrast the functions of cellular respiration and photosynthesis• Explain why cellular respiration is important in living organisms• Distinguish between aerobic and anaerobic respiration and compare the efficiency of the two processes• Create a flow chart that explains the overall scheme of glycolysis• Explain the process of fermentation• Describe the function of the Krebs's Cycle• Test for respiration by completing Cellular Respiration in Germinating Seeds Laboratory Experiment• Complete B Vitamin mini-research activity

- Describe the role of ATP in energy transfer
- Contrast oxidation and reduction and explain why one cannot take place without the other
- Perform food tests for starches, fats and sugars

Resources

- <http://photoscience.la.asu.edu/photosyn/default.html>

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.2 The Organization of Living Things All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions.
Benchmarks	All students will analyze how parts of living things are adapted to carry out specific functions: III.2.4. Explain how selected systems and processes work together in animals. <i>Key concepts: Related systems/cells/chemicals-excretory system, endocrine system, circulatory system, hormones, immune response, white blood cell, bacteria, virus. Factors/mechanisms under control-temperature, disease/infection, homeostasis.</i> <i>Real-world contexts: Mechanisms for maintaining internal stability, such as body temperature, disease control.</i>
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Compare and contrast viruses to living organisms• Complete bacteria webquest activity
Resources	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.3 Heredity All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes.
Benchmarks	All students will investigate and explain how characteristics of living things are passed on through generations: III.3.1. Describe technology used in the prevention diagnosis, and treatment of diseases and explain its function in terms of human body processes. <i>Key concepts:</i> Available technologies- sanitation, adequate food and water supplies, inoculation, antibodies, biochemistry, medicines, organ transplants. (See PWV-IV.4 h.4, ultrasound/ xray.) <i>Real-world contexts:</i> Common contexts for these technologies- health maintenance and disease prevention activities, such as exercise and controlled diets; health monitoring activities, such as cholesterol and blood pressure checks and various tests for cancer.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Complete Online Bacterial DNA Analysis
Resources	<ul style="list-style-type: none">• Bacterial DNA Analysis http://www.hhmi.org/biointeractive/

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.3 Heredity All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes.
Benchmarks	All students will investigate and explain how characteristics of living things are passed on through generations: III.3.1. Explain how characteristics of living things are passed on from generation to generation. <i>Key concepts: Traits- dominant, recessive. Genetic material-gene pair, gene combination, gene sorting, Real-world contexts: Common contexts- inheritance of a human genetic disease/disorder, such as sickle cell anemia; examining animal or plant pedigrees.</i>
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Using paper patterns, construct a model of DNA undergoing transcription and translation• Complete mutations on protein synthesis laboratory investigation• Describe Mendel's experiments.• State and give an example of Mendel's Law of Dominance and Law of Segregation.• Define allele, homogenous, heterozygous, genotype, and phenotype.• Utilize Punnet squares to solve genetic crosses (monohybrid/dihybrid crosses; dominant, recessive, and co-dominant alleles; multiple alleles as in A-B-O blood typing; sex linked traits)• Utilize Pedigree chart to determine genetic inheritance patterns.

Resources

- DNA from the Beginning <http://www.dnaftb.org> and <http://vector.cshl.org/dnaftb/>
- NOVA Video [Cracking the Code of Life](#)
- DNA Interactive <http://www.dnai.org/index.html>
- Genetics Science Learning Center <http://gslc.genetics.utah.edu/>
- Mendel Web <http://www.mendelweb.org>
- Interactive tutorial for replication and protein synthesis <http://www.pbs.org/wgbh/aso/tryit/dna/index.html#>
- Video-[The Race for the Double Helix](#)
- Web reprint of Watson and Crick's original paper <http://biocrs.biomed.brown.edu/Books/Chapters/Ch%2081DH-paper.html>
- Virtual blood typing activity http://www.horton.ednet.ns.ca/staff/selig/AP/labs/Blood_activity.htm

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

**Grade: Middle
School**

Standard	Standard III.3 Heredity All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes.
Benchmarks	All students will explain why organisms within a species are different from one another: III.3.2. Describe how genetic material is passed from parent to young during sexual and asexual reproduction. <i>Key concepts: Types of cell division- mitosis, meiosis. DNA replication, chromosome. Types of reproduction-sexual, asexual. Genetic variation.</i> <i>Real-world contexts: Yeast, reproduction by spores, cloning.</i>
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Complete DNA Detectives Laboratory Investigation• Compare and contrast Meiosis and Mitosis• Identify the stages, structures, and purpose of cell division• Label the stages and structures on a diagram of mitosis• Explain Mendel's Law of Segregation in terms of chromosomes and Meiosis• Create a model to demonstrate Mitosis and Meiosis• Perform Onion Root Tip Laboratory Investigation• Differentiate between chromatid and chromosome; haploid and diploid; homologous and nonhomologous chromosomes
Resources	<ul style="list-style-type: none">• DNA Detectives laboratory available @ http://www.accessexcellence.org/AE/AEC/AEF/1995/black_dna.html• Interactive tutorial with pictures of the different phases of cellular division... http://biog-101-104.bio.cornell.edu/bioG101_104/tutorials/cell_division.html• NOVA Video <u>Garden of Inheritance</u>

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.3 Heredity All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes.
Benchmarks	All students will investigate and explain how characteristics of living things are passed on through generations: III.3.3. Explain how new traits may arise in individuals through chances in genetic material (DNA). <i>Key concepts:</i> Genetic changes- variation, new gene combinations, mutation. Natural and human-produced sources of mutation-radiation, chemicals. See LE-III.4 m.2 (how new traits become established in populations.) <i>Real-world contexts:</i> Products of genetic engineering, such as medical advances- insulin, cancer drugs; agricultural related products, such as navel oranges, new flower colors, higher-yield grains; effects of natural and man-made contamination; examples of variations due to new gene combinations, such as hybrid organisms or new plant varieties resulting from multiple sets of genes.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Complete The Code Unraveled Web quest• Participate in a role play regarding genetically altered corn for food (Genetica's Dilemma)• Complete web quest on genetic engineering of crops• List sources of Genetic variations• Distinguish between gene mutations, chromosomal mutations and jumping genes• Explain causes of mutations• Prepare a written report that explains how gene splicing and cloning experiments pose ethical and procedural problems for society• Complete BioBabies Laboratory Investigation
Resources	<ul style="list-style-type: none">• Geneticas Dilemma information http://www.tccsa.net/webquest/she/• GE web quest http://www.gis.net/~peacewp/webquest.htm

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.4 Evolution All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time.
Benchmarks	All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species: III.4.1. Describe what biologists consider to be evidence for human evolutionary relationships to selected animal groups. <i>Key concepts: Common types of evidence used- hominid fossils, vestigial structures, DNA, protein structure.</i> <i>Real-world contexts: Skeletal comparisons, such as modern human to hominid fossils; anatomical and biochemical similarities of humans and other higher primates, such as blood proteins; similarity of early human embryo stages to those of other vertebrates; vestigial structures, such as appendix, tail bone.</i>
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Identify the evidence that indicates human ancestors walked upright before their brains enlarged• Describe why Dart's discovery was so important in supporting the theory of evolution• Analyze the importance of fossils in describing the evolution of man (Lucy, Homo habilis, and Australopithecines)• Summarize how biological molecules such as proteins and DNA are considered evidence of evolution• Compare the anatomy and development of living species with those of fossils to show evidence of evolution• Compare human skeleton fossils with hominid fossil models• Complete Vestigial Structure lab
Resources	<ul style="list-style-type: none">• Evolution website: http://www.ps.org/wgbh/evolution/index.htm• Evolution lesson plans: http://www.indiana.edu/~ensiweb/evol.fs.html• http://www.mnh.si.edu/anthro/humanorigins/ This is Smithsonian Institutes Human Origins Program about fossil record left by early humans

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.4 Evolution All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time.
Benchmarks	All students will compare ways that living organisms are adapted (suited) to survive and reproduce in their environments and explain how species change through time: III.4.2. Explain how a new species or variety may originate through the evolutionary process of natural selection. <i>Key concepts: Concept of species; how new species or varieties are established- natural selection, inheritable, non-inheritable characteristics, species variation.</i> <i>Real-world contexts: Contemporary examples of natural selection, such as bacteria resistance to antibiotics, insect resistance to pesticides; examples of artificial selection, such as agricultural selection to increase production, selecting desired traits for pets; historical examples of naïve explanations of evolution, such as the Lamarkian explanation of the evolution of the giraffe's long neck.</i>
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Track endangered birds and animals via satellite tracking• Complete Evolution and Its Effect Through Geological Time• Complete Peppered moth Study Laboratory Investigation• Complete Fishy Frequencies Laboratory Investigations• Compare Modern-Day life forms with those found in fossil records• Investigate how variation of Organismal traits, reproductive modes, and environmental pressures affect survival of populations• Perform a simulation activity involving natural selection and a population of multi-colored insects• List the principles of Darwin's Theory of Natural Selection• Demonstrate how natural selection can affect allele frequencies via completion of natural Selection and Allelic Frequency Laboratory• Measure and graph variation populations of organisms• Explain the roles of variation, reproductive and geographic isolation in speciation• Complete online Chips are Down Natural Selection Simulation

Resources

- Satellite tracking site= <http://www.spacetoday.org/Satellites/Tracking/Resources.html>
- Website that provides information on endangered species and conservation efforts = <http://www.endangeredspecie.com>
- Chips are Down Natural Selection= <http://www.indiana.edu/~ensiweb/lessons/ns.chips.html>

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.
Benchmarks	All students will explain how parts of an ecosystem are related and how they interact: III.5.1. Describe common ecological relationships between and among species and their environments. <i>Key concepts:</i> Competition, territory, carrying capacity, natural balance, population, dependence, survival: biotic, a biotic factors. <i>Real-world contexts:</i> Animals that live in packs or herds and plant colonies, such as- wolves, bison, lilies and other bulb plants, various forms of algae.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Describe general traits regulating population size in ecosystems• Embark on field trip to Wolf Lake fishery on M-43 west of Kalamazoo• Complete Population Growth and Balance simulated Experiments• Engage in “A River Runs Through It” online activity• Participate in the Virtual Field Trip on Animal Defense• Define an ecosystem, highlighting the importance of biotic and abiotic factors• Describe the major types of species interactions including predation, competition and symbiosis• Define and describe various biomes and analyze how species adapt to fit these surroundings• Explain the terms population, community, ecosystem, biosphere, heterotrophic and autotrophic• Identify interactions within and among populations in terms of growth curves, limiting factors, and carrying capacity

Resources

- A River Runs Through It = <http://scorescience.humboldt.k12.ca.us/fast/teachers/River/index.htm>
- Population & Growth Balance Simulated Experiments = <http://www.arcytech.org/java/population/>
- Earthtrends Portal. A website that provides information about natural resources and protection of ecosystems = <http://earthtrends.wri.org/>
- Virtual Field Trip = <http://www.field-trips.org/sci/fierce/index.htm>

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.
Benchmarks	All students will explain how energy is distributed to living things in an ecosystem: III.5.2. Explain how energy flows through familiar ecosystems. <i>Key concepts:</i> Participants and relationships-food chain, food web, energy pyramid, energy flow, producers, consumers, decomposers. See LO-III.2 m.3 (producers), PCM-IV.2 h.4 (conservation of energy). <i>Real-world contexts:</i> Energy pyramids for food webs in various ecosystems.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Describe the feeding relationship in an ecosystem in terms of food chains, food webs, and competition• Describe the roles of sunlight, producers, consumers, and decomposers in food chains and food webs• Create an interactive powerpoint presentation of an ecosystem portraying the producers, consumers and decomposers within it• Analyze energy transfer among organisms at various trophic levels• Explain the flow of energy in an ecosystem using the concepts of pyramids of energy and biomass• Create a poster that illustrates both aquatic and terrestrial food webs• Describe the following biogeochemical cycles: Nitrogen, carbon, oxygen and water• Create a poster of the Nitrogen cycle, the carbon cycle, the oxygen cycle or the water cycle
Resources	<ul style="list-style-type: none">• Website on major Biomes = http://www.ucmp.berkeley.edu/glossary/gloss5/biome/• Site on ecosystems/energy flow and biomass pyramids= http://www.marietta.edu/~biol/102/ecosystem.html

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.
Benchmarks	All students will investigate and explain how communities of living things change over a period of time: III.5.3. Describe general factors regulating population size in ecosystems. <i>Key concepts:</i> Carrying capacity, competition, parasitism, predation, loss of habitat. <i>Real-world contexts:</i> Common factors that influence relationships, such as weather, disease, predation, migration.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Describe the factors that affect any population's size and explain why populations grow. List at six factors that limit the population growth• Describe some of the problems that stem from the explosive growth of the human population and present solutions to these problems.• Compare and contrast primary and secondary succession• Create a chart of the major terrestrial biomes listing the limiting factors, topography, and the typical organisms of the communities.• Identify the interrelationships among organisms, populations, ecosystems, and biomes by completing Biomes and Climatograms Laboratory Activity
Resources	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

<p>Standard</p>	<p>Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.</p>
<p>Benchmarks</p>	<p>All students will investigate and explain how communities of living things change over a period of time: III.5.4. Describe responses of an ecosystem to events that cause it to change. <i>Key concepts:</i> Succession, pioneer, climate/physical conditions, introduction of new/different species, elimination of existing species, biodiversity; cataclysmic changes.. <i>Real-world contexts:</i> Climax forests comprised of maple, beech, or conifers; effects of urban sprawl or clear cutting forests; effects of cataclysmic changes such as the eruption of Mt. St. Helens.</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Assess and explain three human activities that modify or influence the environment: Global warming; pesticide use; human population growth • Read autobiography of Rachel Carson • Describe primary and secondary succession, emphasizing the importance of pioneer species • Explain the relationship between primary succession and the formation of soil
<p>Resources</p>	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.
Benchmarks	All students will describe how materials cycle through an ecosystem and get reused in the environment: III.5.5. Describe how carbon and soil nutrients cycle through selected ecosystems.. <i>Key concepts:</i> Common nutrients/elements—nitrogen, sulfur, carbon, phosphorous, Inorganic compounds containing nutrients—soil minerals, carbon dioxide. Organic compounds in living communities—protein, fat, carbohydrates. See LO-III.2 h3 (cell respiration) and LO-III.2m.3 (photosynthesis). <i>Real-world contexts:</i> Movement of food materials through various foodwebs, including decomposition.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Make a flow chart of the carbon cycle• Analyze the effects of human activities on the carbon cycle• Describe the importance of nitrogen-fixing bacteria to sustaining an ecosystem
Resources	

Science Curriculum

Strand III. Using Scientific Knowledge in Life Science

Grade: High School

Standard	Standard III.5 Ecosystems All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.
Benchmarks	All students will analyze how humans and the environment interact: III.5.6. Explain the effects of agriculture and urban development on selected ecosystems. <i>Key concepts:</i> common factors that influence ecosystems, such as pollution of ecosystems from fertilizer, insecticide, and other chemicals. Land management, biodiversity, sustainability. Loss of habitat. See PME-IV. 1.h.1 (risk/benefit analysis), EH-V.2.h.2 (water pollution). <i>Real-world contexts:</i> Common factors that influence ecosystems, such as pollution of ecosystems from fertilizer, insecticide, and other chemicals.
Sample Activity/Assessment tasks	*
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	Standard IV.1 Matter and Energy All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.
Benchmarks	All students will measure and describe the things around us: IV.1.1 Analyze properties of common household and agricultural materials in terms of risk/benefit balance. <i>Key concepts:</i> Risk/benefit analysis <i>Real-world contexts:</i> Herbicides, refrigerants, fertilizers, detergents.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Examine the contents of refrigerants, herbicides, fertilizers and detergents and determine the risks and benefits of use.• Explain how pesticides work, why they are used and the toxicological effects they could have on an ecosystem
Resources	<ul style="list-style-type: none">• Web site on Michigan risk/benefit fertilizers= http://www.aquaweed.com/riskbenltr.htm• Environmental Risk Sciences= http://www.erisk.com

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.1 Matter and Energy All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.</p>
Benchmarks	<p>All students will measure and describe the things around us: IV.1.2. Identify properties of common families of elements. <i>Key concepts:</i> properties—state, reactivity, metal/nonmetal, conductivity. <i>Tools:</i> Various element samples. <i>Real-world contexts:</i> Highly reactive metals (such as potassium, sodium), less-reactive metals (such as calcium), highly reactive nonmetals (such as chlorine, fluorine, and oxygen), almost completely nonreactive gases (such as helium and neon); relationships on the Periodic Table of Elements.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe and explain the rows and columns of the periodic table • Explain similarities in chemical activity to placement in the periodic table • Compare the properties of nonmetals and metals and their placement in the periodic table • Explain metallic bonding • List properties of elements in the alkali metal, noble gas and halogen families • Identify elements via Flame Test Laboratory Investigations • Compare and contrast the properties of metals and nonmetals • Compare and contrast ionic and covalent bonding in terms of nuclei, attractions and electrons • Explain ionization energy and electron affinity • Calculate molecular masses for given compounds • Explain electron configuration and how electron configuration can be used to identify its row in the periodic table • Explain why nonmetals tend to gain electrons • Write and balance chemical equations
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.1 Matter and Energy All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.</p>
Benchmarks	<p>All students will explain what the world around us is made of: IV.1.3. Explain how elements differ, in terms of the structural parts and electrical charges of atoms. <i>Key concepts:</i> Parts of atoms—nucleus, electron cloud. Subatomic particles—proton, neutron, electron. Electrical charges—positive, negative, neutral. Each element has a unique number of protons. See PMO-IV.3 m.3 (electrical force) <i>Real-world contexts:</i> All elements.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe various models of atoms to show how the concept of atomic structure has developed through the years • List the main subatomic particles and make a diagram illustrating their arrangement in a typical atom • Explain the terms atom, nucleus, electron cloud, proton, neutron, electron, atomic mass, atomic number, mass number, and isotope • Compare and contrast the processes of alpha, beta, and gamma decay • Discuss the placement of electrons within an atom • Using reference books, research nuclear physicist Maria Goeppert Mayer. Prepare a report on her life, scientific work/Nobel prize. • Construct models of isotopes • Complete electron configuration diagrams • Explain how Rutherford's model of the atom was supported by experimental evidence

Resources

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Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.1 Matter and Energy All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.</p>
Benchmarks	<p>All students will explain how electricity (and magnetism; see PMO) interact with matter: IV.1.4 Explain how current is controlled in simple series and parallel circuits. <i>Key concepts:</i> Single path, multiple paths, switches, fuses, circuit breakers, power supply, batteries, household current, motors, bulbs, circuit diagrams. <i>Real-world contexts:</i> Basic household wiring, automobile wiring, flashlights, tree lights, power lines, electrical conductivity testing.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Explain two kinds of electrical charges and how they are produced • Demonstrate the principles of conduction and induction • Explain the concepts of current, voltage, and resistance • Interpret and construct circuit diagrams • Identify circuits as series or parallel • Identify circuits as open or closed • Connect a bulb in a simple series circuit • Calculate the resistance for a circuit of resistors in series, and find the current in and potential difference across each resistor in the circuit • Calculate the resistance for a circuit of resistors in parallel, and find the current in and potential difference across each resistor in the circuit • Calculate the equivalent resistance for a complex circuit involving both series and parallel sections • Calculate current and potential difference within a complex circuit • Research the career of an electrical engineer or technician • Given a house electrical plan, study the diagram to identify the circuit breakers, their connections to home appliances, and the limitations they may impose upon the circuit's design. Determine the average current in each appliance in the house. Prepare a diagram that portrays which circuit breakers control which appliances. • Complete a Resistors in Series and in Parallel Laboratory Investigation

Resources

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Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.1 Matter and Energy All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter.</p>
Benchmarks	<p>All students will explain how electricity (and magnetism; see PMO) interact with matter: IV.1.5. Describe how electric currents can be produced by interacting wires and magnets, and explain applications of this principle. <i>Key concepts and tools:</i> current flow and direction, magnetic fields. See PMO-IV.3 m.4 (magnetism from electricity). <i>Real-world concepts:</i> Generators, alternating current, direct current.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe the properties of magnets • Explain natural and induced magnetism • Describe the relationship between electric currents and magnetism • Apply the principles of magnetic induction to generators, motors, and transformers • Describe the magnetic field around a permanent magnet • Draw a diagram reflecting the magnetic field surrounding a magnet • Complete Magnetic Fields Laboratory Investigation • Explain magnetism in terms of the domain theory of magnetism • Utilize the right hand rule to determine direction of magnetic field/current direction for a given situation • Given the force on a charge in a magnetic field, determine the strength of the magnetic field • Construct an artificial magnet • Construct an electromagnet • Explain the Earth's magnetic field • Explain how the contributions of Oersted, Peregrinus, Gilbert, Faraday and Ampere advanced the understanding of electromagnetism • Use the right-hand rule to explain how a galvanometer works • Complete Magnetic Field of a Conducting Wire Laboratory Experiment
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

<p>Standard</p>	<p>Standard IV.2 Changes in Matter All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.</p>
<p>Benchmarks</p>	<p>All students will explain how visible changes in matter are related to atoms and molecules: IV.2.1 Explain chemical changes in terms of the breaking of bonds and the rearrangement of atoms to form new substances. <i>Key concepts:</i> atom, molecule, ion, bond reactant, product; conservation of mass; rate of reaction—temperature, surface area, concentration; specific chemical reactions—burning of paper or wood, rusting iron, formation of sugars during photosynthesis. See PME-IV.1 h.3 (structure of the atom). <i>Real-world contexts:</i> Examples of chemical changes—see PCM-IV.2 m.2</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Explain the Law of Conservation of Mass • Describe the energy changes that occur during chemical reactions • Write and balance chemical reactions • Identify product and reactants of a chemical reaction • Explain limiting factors of a chemical reaction • Use the collision theory to explain reaction rates, Include the role that temperature, concentration and catalysts play • Compare and contrast exothermic and endothermic reactions • Complete Energy and Chemical Change Laboratory Investigation
<p>Resources</p>	

Standard	Standard IV.2 Changes in Matter All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.
Benchmarks	I All students will explain how visible changes in matter are related to atoms and molecules: IV.2.2. Explain why mass is conserved in physical and chemical changes.. <i>Key concepts:</i> atom, molecule, mass. <i>Real-world contexts:</i> Common physical and chemical changes, including matter cycles in ecosystems.
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Explain the Law of Conservation of Mass
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

<p>Standard</p>	<p>Standard IV.2 Changes in Matter All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.</p>
<p>Benchmarks</p>	<p>All students will explain how visible changes in matter are related to atoms and molecules: IV.2.3. Contrast nuclear fission, nuclear fusion, and natural radioactivity. <i>Key concepts:</i> Nucleus, nuclear change, force that hold nucleus together, nuclear energy. Stable and unstable isotopes. Properties—mass, element, radioactivity. See PME-IV.1 h.3 (structure of the atom). <i>Real-world contexts:</i> Nuclear power plants, nuclear energy from sun, natural radioactive decay, use of radiation and radioactive isotopes in medicine.</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Identify the properties of the nucleus of an atom • Explain why some nuclei may lack stability • Explain an isotope • Explain alpha, beta, and gamma decay • Predict the products of nuclear decay • Calculate the half-life of a radioactive substance • Compare and contrast nuclear fission and fusion • Prepare a report on Marie Curie and her contributions to physics • Prepare a Powerpoint presentation on the production of nuclear energy power
<p>Resources</p>	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

<p>Standard</p>	<p>Standard IV.2 Changes in Matter All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.</p>
<p>Benchmarks</p>	<p>All students will explain how changes in matter are related to changes in energy and how living things and human technology change matter and transform energy. IV.2.4. Describe common energy transformations involved in physical, chemical, and nuclear changes, and contrast their relative magnitudes. <i>Key concepts:</i> Potential energy, kinetic energy, heat, light, electrical energy, chemical energy, sound, temperature changes. Original sources of energy, sun, radioactivity. Conservation of energy, conservation of mass/energy; $E=mc^2$. See PCM-IV.2 m.4 (common energy transformation), PCM-IV.2 h.3 (nuclear changes). <i>Real-world contexts:</i> Common physical, chemical, and nuclear changes, including changes of state, burning, electrical decomposition of water, photosynthesis, cellular respiration, fireworks and dynamite, nuclear power, stars.</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Identify forms of energy • Explain the Law of Conservation of Energy • Solve problems using conservation of mechanical energy • Explain how energy and work are related • Apply the work-kinetic energy theorem to solve problems • Compare and contrast Kinetic and Potential Energy • Calculate kinetic energy for an object • Classify various types of potential energy • Calculate potential energy associated with the position of an object • Solve for the potential energy in a compressed or stretched object • Explain the connection between power, energy and time • Design and construct a Rube-Goldberg project. Explain each step of the process in terms of the physics
<p>Resources</p>	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	Standard IV.2 Changes in Matter All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy.
Benchmarks	All students will explain how changes in matter are related to changes in energy and how living things and human technology change matter and transform energy. IV.2.5. Explain changes in matter and energy involving heat transfer. <i>Key concepts:</i> Mechanisms of heat transfer—convection, conduction, radiation. Conservation of energy, efficiency. Changes in matter related to heat transfer—changes in temperature, volume, pressure. See PCM-IV.2 m.1. <i>Real-world contexts:</i> Convection currents, lake turnover, wind, hot frying pans, heating and cooling buildings, heat lamps, sunlight heating the earth, greenhouse effect, fires for warming.

Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Compare and contrast convection, conduction and radiation • Compare and contrast heat and temperature • Create a poster illustrating how currents in the oceans are caused by heat, wind, gravity and the Coriolis Effect • Explain the Kinetic Theory • Prepare an oral presentation explain how various types of heating or refrigeration systems work • Explain how temperature effects the kinetic energy of atoms & molecules • Identify the three major temperature scales and convert temperatures from one scale to another • Explain what is meant by thermal equilibrium • Explain the changes in temperature of two objects attaining thermal equilibrium • Calculate the specific heat capacity of a given substance • Perform Calorimetry Laboratory Investigation • Interpret the various sections of a heating curve • Perform calculations involving latent heat • Explain how energy is transferred as heat through the process of conduction • Create a poster explaining the Greenhouse Effect • Research information on solar water heaters. Explain the methodology behind how each works. Compare operating costs for a solar water heater versus a gas water heater. Determine other advantages and limitations a solar water heater may have. Create a brochure detailing this technology. • Perform Specific Heat Capacity Laboratory Investigation
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

<p>Standard</p>	<p>Standard IV.3 Motion of Objects All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions.</p>
<p>Benchmarks</p>	<p>All students will describe how things around us move, explain why things move as they do, and demonstrate and explain how we control the motions of objects: IV.3.1. Analyze patterns of force and motion in the operation of complex machines. <i>Key concepts:</i> Electrical and/or mechanical components of complex machines. <i>Real-world contexts:</i> Machines, such as bicycles, automobiles, pumps, electrical motors,</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Measure the work input and output of several machines • Calculate efficiencies of machines • Compare machines based on efficiencies • Explain factors that affect the efficiency of a machine • Complete Machines Efficiency Laboratory Investigation • Prepare a “How it Works” oral presentation. Research and prepare a presentation on the mechanics behind a common household device. (Refrigerator, air conditioner, vacuum cleaner, freezer, home heating system etc...)
<p>Resources</p>	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

<p>Standard</p>	<p>Standard IV.3 Motion of Objects All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions.</p>
<p>Benchmarks</p>	<p>All students will relate motion to energy and energy conversions: IV.3.2. Explain energy conversions in moving objects and machines. <i>Key concepts:</i> Types of energy—electrical energy, kinetic energy, gravitational potential energy, potential energy in springs, chemical potential energy, heat energy, radiation. Energy transformations—see PCM-IV.2 m.4 efficiency. See PME-IV.1h.4 (conservation of energy) and PCM-IV.2 h.4 (energy in physical and chemical changes). <i>Real-world contexts:</i> Simple and complex machines, roller coasters, swings, pendulums, elevators, automobiles, fans, motors.</p>
<p>Sample Activity/Assessment tasks</p>	<ul style="list-style-type: none"> • Explain the Law of Conservation of Energy • Identify and explain the six simple machines • Solve problems using conservation of mechanical energy • Explain how energy and work are related • Apply the work-kinetic energy theorem to solve problems • Compare and contrast Kinetic and Potential Energy • Calculate kinetic energy for an object • Classify various types of potential energy • Calculate potential energy associated with the position of an object • Solve for the potential energy in a compressed or stretched object • Explain the connection between power, energy and time • Embark on a field trip to Cedar Point to investigate the Physics of Amusement Parks

Resources

- Cedar Point has established “Physics Days”. Contact park for more information
<http://www.cedarpoint.com>
- Site on Physics of Roller Coasters = http://www.thehumorwriter.com/Kids_Corner_--_Original_Storie/Roller_Coasters/roller_coasters.html
- Site on Amusement Park Physics = <http://library.thinkquest.org/2745/data/openpark.htm>
- [Energy in Archery from Newton's Apple](http://www.pbs.org/ktca/newtons/10/archery.html)
<http://www.pbs.org/ktca/newtons/10/archery.html>
- [Slinky Physics with Newton's Apple](http://www.ktca.org/newtons/9/slink.html)
<http://www.ktca.org/newtons/9/slink.html>
- [Breaking Energy](http://sportsfigures.espn.com/sportsfigures/lp_energy.jsp?iAm=null)
http://sportsfigures.espn.com/sportsfigures/lp_energy.jsp?iAm=null

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.4 Waves and Vibrations All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy.</p>
Benchmarks	<p>All students will describe sounds and sound waves: IV.4.1 Relate characteristics of sound that we hear to properties of sound waves.. <i>Key concepts:</i> Properties of sound—pitch, volume. Characteristics of sound waves—frequency, amplitude, velocity. <i>Real-world contexts:</i> common sounds that vary in pitch and volume—see PMV-IV.4 c.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Explain how sound waves are produced and how they travel from one place to another • Explain the relationship of frequency to pitch • Describe a longitudinal wave and explain how energy is transmitted along a wave • Recognize the Doppler Effect, and determine the direction of frequency shift when there is relative motion between a source and an observer • Explain how resonance and interference takes place • Explain why different materials produce different sounds • Explain how the amplitude of a wave is related to its intensity • Explain constructive and destructive interference • Explain timbre • Complete Pitch and Length laboratory Investigation • Calculate frequencies • Complete Speed of Sound Laboratory Investigation • Complete Webquest on Light/Sound Wave
Resources	<ul style="list-style-type: none"> • Webquest Light and Sound =

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	<p>Standard IV.4 Waves and Vibrations All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy.</p>
Benchmarks	<p>All students will explain shadows, color, and light phenomena: IV.4.2. Explain how we see colors of objects. <i>Key concepts:</i> Characteristics of light—brightness, amplitude, colors of spectrum (red, orange, yellow, green, blue, indigo, violet)wavelength, frequency (see PMV-IV.4 m.4 <i>Real-world contexts:</i> Colored light-reflecting objects, such as books, clothes, color photographs; colored light-transmitting objects, such as stained glass, cellophane; colored light-emitting objects, such as television, neon lights. Scattering of light by the atmosphere.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe the parts of a transverse wave • Explain reflection, refraction and diffraction • Explain how colored light is combined, absorbed, and transmitted • Explain the difference between transparent and opaque • List the primary colors for light. • List the primary colors for pigments • Explain how additive colors affect the color of light • Explain how pigments affect the color of reflected light • Complete Web quest on Light/Sound Waves
Resources	<ul style="list-style-type: none"> • Web quest Light and Sound = http://hs.n-polk.k12.ia.us/departments/media/wave.html

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science

Grade: High School

Standard	Standard IV.4 Waves and Vibrations All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy.
Benchmarks	All students will measure and describe vibrations and waves: IV.4.3. Describe waves in terms of their properties. <i>Key concepts:</i> Mechanical waves, electromagnetic waves—see PMV-IV.4 h.4. Colors of light. Properties of waves—frequency, amplitude, wavelength, wave velocity, energy. Units of measurement—hertz or cycles per second, micrometers, meters, meters per second. <i>Tools for making spectra:</i> Prism, diffraction, grating. <i>Real-world contexts:</i> Examples of mechanical and electromagnetic waves—see PWV-IV.4 h.4. Colors of light, frequencies of radio and TV transmission.

Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe the parts of a transverse wave • Diagram mechanical and transverse waves • Explain reflection, refraction and diffraction
Resources	

Science Curriculum

Strand IV. Using Scientific Knowledge in Physical Science	Grade: High School
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Standard	Standard IV.4 Waves and Vibrations All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy.
Benchmarks	All students will measure and describe vibrations and waves: IV.4.4. Describe different types of waves and their technological applications. <i>Key concepts:</i> Types of waves—mechanical: sound, ultrasound, water waves, shock wave; electromagnetic: radio waves, microwaves, radiant heat, infrared radiation, visible light, ultraviolet radiation, x-rays. Properties of waves—see POMV-IV.4 h.3. See PCM-IV.2 m.4 (energy transformation). <i>Real-world contexts:</i> Examples of mechanical waves—sound, ultrasound, ocean waves, wave tanks, earthquakes, seismic waves; examples of electromagnetic waves, such as light—see above radio and television signals, heat lamps, microwave transmitter, radar, ultraviolet radiation in sunlight, x-ray machines, CAT-scans, gamma rays from radioactive decay.

Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Prepare a “How it Works” oral presentation. Research and prepare a presentation on the mechanics behind a technological device such as a microwave oven, ultrasound, television set, radio, compact-disc player, DVD player etc...
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science	Grade: High School
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Standard	Standard V.1 The Geosphere All students will describe the earth’s surface; describe and explain how the earth ’s features change over time; and analyze effects of technology on the earth’s surface and resources.
Benchmarks	All students will describe and explain how the earth’s features change over time: V.1.1. Explain the surface features of the Great Lakes region using Ice Age theory. <i>Key concepts:</i> Glacial processes—climate change, snow changing to ice, pressure, moving (advance, retreat), melting; deposits; features—hills, lakes, Great Lakes. See EAW-V.3 h.1 (long term climate change.) <i>Tools:</i> Relief map, topographic map, elevation map. <i>Real-world contexts:</i> Examples in Michigan of glacial formation, such as moraines, kettles, drumlins.

Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe how glaciers form • Compare and contrast the two main kinds of glaciers • Explain two processes by which glaciers move • Describe the landscape features that are produced by glacial erosion • Name and describe five features formed by glacial deposition • Explain how lakes are formed by glacial action • Describe the climatic cycles that exist during an ice age • Identify and summarize the theory that best accounts for the ice ages • Complete glaciers and sea level laboratory investigation
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science	Grade: High School
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Standard	Standard V.1 The Geosphere All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources.
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Benchmarks

All students will describe and explain how the earth's features change over time:

V.1.2. Use the plate tectonics theory to explain features of the earth's surface and geological phenomena and describe evidence for the plate tectonics theory..

Key concepts: Earth composition—crust, mantle: upper part is able to flow very slowly; core interior at high temperature and pressure (see ES-V.4 h.3.) Forces—tensions, compression, shearing. Plates, continental crust, oceanic crust. Features—faults, trenches, mid ocean ridges, folded mountains, hot spots, volcanoes. Related actions—earthquakes (see PMV-IV.4 m.6), volcanic activity, seafloor spreading, mountain building, convection in mantle. Evidence of “continental drift”—physical fit of continents, fossil evidence, measurements of movement, rock layer sequences, glacial evidence. See Reflecting on Scientific Knowledge benchmarks related to evidence and theory.

Real-world contexts: Recent patterns of earthquake and volcanic activities; maps showing the direction of movement of major plates and associated earthquake and volcanic activity; compressional boundaries: folded mountains, thrust faults; trenches, lines of volcanoes (e.g. Pacific “ring of fire”) tensional boundaries: mid ocean ridges, rift valleys; shearing boundaries: lateral movement producing faults (e.g. San Andreas Fault).

Sample Activity/Assessment tasks	<ul style="list-style-type: none">• List the characteristics of the earth's three major zones• Explain how studies of seismic waves have provided information about the earth's interior• Define magnetosphere and identify the possible source of the earth's magnetism• Explain Wegner's hypothesis of Continental Drift• List evidence for Wegner's hypothesis of Continental Drift• Describe seafloor spreading• Summarize the theory of plate tectonics• Compare and contrast characteristic geologic activities that occur along the three types of plate boundaries• Explain the role of convection currents in plate movement• Write a report explaining what geologic evidence exists to indicate that the magnetic fields of the earth have changed greatly in the past 500 years. Include information on the magnetic bands located around areas of seafloor spreading and how scientists interpret these finding.• Complete model of convection currents laboratory investigation.
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	<p>Standard V.1 The Geosphere All students will describe the earth’s surface; describe and explain how the earth ’s features change over time; and analyze effects of technology on the earth’s surface and resources.</p>
Benchmarks	<p>All students will analyze effects of technology on the earth’s surface and resources: V.1.3. Explain how common objects are made from earth materials and why earth materials are conserved and recycled. <i>Key concepts:</i> Valuable materials—minerals, metallic ores, iron, copper, aluminum, fuels. Types of resources-renewable, nonrenewable. Conservation, limits, recycling; costs for developing more remote supplies. Manufacturing, refining, mining. Recycling processes—melting, shredding, dissolving. <i>Real-world contexts:</i> Manufacturing processes—steel mills, auto assembly lines, paper making; local recycling center for materials, such as glass, plastic, aluminum, steel cans, motor oil; examples of technical and social means for slowing depletion of earth’s resources, such as developing more fuel-efficient cars and mandating their use; disposal in landfills and incinerators.</p>
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	<p>Standard V.1 The Geosphere All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources.</p>
Benchmarks	<p>All students will analyze effects of technology on the earth's surface and resources: V.1.4. Evaluate alternative long range plans for resource use and by-product disposal in terms of environmental and economic impact. <i>Key concepts:</i> Understanding of limitations of knowledge and technology (see R-II.1 h.2), side effects of resource use (see PME-IV.1h 1), risk/benefit analysis). Also see R-II.1h.5 (new technologies), EAW-V.3 h.4 (air Pollution). <i>Real-world contexts:</i> Industries for mining, energy production, manufacturing, transportation, housing. <i>Resources including fossil fuels, metals, wood, water. Pollution prevention and events, such as catalytic converters, Love Canal, Superfund waste sites.</i></p>
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	<p>Standard V.2 The Hydrosphere All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere.</p>
Benchmarks	<p>All students will describe how water moves: V.2.1. Identify and describe regional watersheds. <i>Key concepts:</i> Drainage basins, divides, reservoirs, tributaries, run-off. <i>Tools:</i> Maps <i>Real-world contexts:</i> Local and regional watersheds, Great Lakes Basin, continental Divide; planning water management, evaluating potential disposal sites; analyzing pollution events which concern both surface and ground water.</p>
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Outline the stages of the water cycle. • Explain the components of a water budget. • List two approaches to water conservation. • Describe the way in which a river develops. • Explain how a stream causes erosion. • Describe youthful, mature, and old river valleys. • List 2 types of stream deposition and explain the differences between them. • Describe the change in a stream that causes flooding. • Identify direct and indirect methods of flood control • Select a major river system in your area. Prepare a poster sized map that shows the main stream channel, major tributaries, watershed, divides, waterfalls, deltas, and oxbow lakes. Clearly label each. • Complete research within your community to find out; how much precipitation your area receives, how much runs off into streams and rivers, and how much becomes groundwater. Determine how the water budget changes with the seasons. Summarize your findings.

Resources	
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Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science	Grade: High School
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Standard	Standard V.2 The Hydrosphere All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere.
Benchmarks	All students will analyze the interaction of human activities with the hydrosphere: V.2.2. Describe how human activities affect the quality of water in the hydrosphere. <i>Key concepts:</i> Human activities—agriculture, fishing, manufacturing, energy production. Quantity of water—rate of use, urbanization. Oceans—oil spills, garbage, global warming, marine life. Freshwater pollution—industrial waste disposal, agricultural runoff, herbicides, pesticides, sewage, acid rain, nutrient levels. Ground water—landfills, leaching, disposal of toxic wastes. Purification technology—filtering, chlorination. Limits to natural resources. <i>Real-world contexts:</i> Examples of local and regional human activities that have measurable effects on water, including farming, industry, sewage disposal, toxic waste disposal.
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Research how waste water from local plants and sewage from residential areas are treated. Create a power point presentation of your finding. Include recommendations to help conserve water.
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.3 The Atmosphere and Weather All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere.
Benchmarks	All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time: V.3.1. Explain how interactions of the atmosphere, hydrosphere and geosphere create climates and how climates change over time. <i>Key concepts:</i> Average yearly temperatures; ice ages, volcanic dust in atmosphere, greenhouse effect, global air circulation, effects of latitude, effects of landforms, ocean currents. <i>Real-world contexts:</i> Causes of short-term climate changes, such as catastrophic volcanic eruptions and impact of solar system objects; evidence of long-term climate changes, such as ice ages, global warming. El Nino, La Nina.
Sample Activity/Assessment tasks	

Resources

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Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.3 The Atmosphere and Weather All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere.
Benchmarks	All students will explain what causes different kinds of weather: V.3.2. Describe patterns of air movement in the atmosphere and how they affect weather conditions. <i>Key concepts:</i> Air movement—air masses, fronts, pressure systems, prevailing winds, jet stream. <i>Real-world contexts:</i> Reports of local weather patterns influenced by the jet stream and prevailing winds.
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

<p>Standard</p>	<p>Standard V.3 The Atmosphere and Weather All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere.</p>
<p>Benchmarks</p>	<p>All students will explain what causes different kinds of weather: V.3.3. Explain and predict general weather patterns and storms. <i>Key concepts:</i> Weather patterns—cold front, warm front, stationary front, air mass, high and low pressure systems. Storms—thunderstorms, lightning and thunder, tornadoes, hurricanes, winds, blizzards. Buoyancy, thermal expansion, convection. See PCM-IV.2 m.1 (thermal expansion) and PME-IV.1 m.1 (density) <i>Tools:</i> Weather maps, thermometer, hygrometer, barometer, anemometer, wind vane, rain gauge, satellite and radar monitoring (see PWV-IV.4 h.4). <i>Real-world contexts:</i> Observable daily weather patterns; examples of weather reports from TV, radio, newspapers, including representation on weather maps. Reports of local weather patterns influenced by the jet stream and prevailing winds.</p>
<p>Sample Activity/Assessment tasks</p>	
<p>Resources</p>	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.3 The Atmosphere and Weather All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere.
Benchmarks	All students will analyze the relationships between human activities and the atmosphere: V.3.4. Explain the impact of human activities on the atmosphere and explain ways that individuals and society can reduce pollution. <i>Key concepts:</i> Air pollution—car exhaust, industrial emissions, smog. Related effects—breathing problems, acid rain, global warming, deforestation, ozone depletion. See EG-V.1 h.4 (resource use). <i>Real-world contexts:</i> Examples of human activities that affect the atmosphere, including use of aerosol spray cans, discharge from smoke stacks, car exhaust, burning leaves and wood in stoves and fireplaces, climate change, global warming; actions, including turning off lights, turning down heat, tuning-up cars, filling tires, driving at a consistent speed; mandating higher fuel efficiencies, energy savings from recycling.
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.4 The Solar System, Galaxy and Universe All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe.
Benchmarks	All students will compare and contrast our planet and sun to other planets and star systems. V.4.1 Compare our sun to other stars. <i>Key concepts:</i> Temperatures, colors, sizes, apparent and absolute brightness; double stars. <i>Real-world contexts:</i> Observing color and brightness of stars, observing double stars.
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.4 The Solar System, Galaxy and Universe All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe.
Benchmarks	All students will describe and explain how objects in the solar system move. V.4.2. Describe the position and motion of our solar system in our galaxy and the overall scale, structure and age of the universe. <i>Key concepts:</i> Stars, galaxies, Milky Way, spiral structure, speed of light, light year, travel times, big bang, red shift. <i>Tools:</i> Telescopes, binoculars, <i>spectroscopes</i> <i>Real-world contexts:</i> Observations of other stars, star clusters, nebulas, and galaxies, observations of other potential planetary systems, accounts of possible travel to other star systems.
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.4 The Solar System, Galaxy and Universe All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe.
Benchmarks	All students will explain scientific theories as to the origin of the solar system: V.4.3. Explain how stars and planetary systems form and how stars produce energy <i>Key concepts:</i> Processes of formation—coalescence from clouds of dust and gases by gravity; explosions of stars producing heavy elements; hydrogen, helium. <i>Real-world contexts:</i> Nebulas considered to be star-forming regions, supernovas, nuclear fusion research.
Sample Activity/Assessment tasks	
Resources	

Science Curriculum

Strand V. Using Scientific Knowledge in Earth Science

Grade: High School

Standard	Standard V.4 The Solar System, Galaxy and Universe All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe.
Benchmarks	All students will explain how we learn about the universe. V.4.4.Explain how technology and scientific inquiry have helped us learn about the universe. <i>Key concepts:</i> Information—radiant energy, radio waves, light, spectra, color of stars, moon and meteor samples. Devices—radio, optical and other types of telescopes, space probes, satellites, computer imaging/modeling (see PWV-IV.4 h.4). <i>Real-world contexts:</i> Histories of discoveries, stories of exploration, visits to observatories and planetariums; videos showing space exploration; samples of space materials, including moon rocks and meteorite; remote sensing data; SETI—Search for Extraterrestrial Life.
Sample Activity/Assessment tasks	
Resources	

