

Connecticut Science Curriculum Standards, March 2009
Middle School Science Grades 5 - 8

© Boardworks 2010

MIDDLE SCHOOL SCIENCE		Boardworks Middle School Science Presentation
Grade 5		
Energy Transfer and Transformations		
5.1 - Sound and light are forms of energy.		
5.1.a. Sound is a form of energy that is produced by the vibration of objects and is transmitted by the vibration of air and objects.		
1. Generalize that vibrating objects produce sound if the vibrations are transferred from the object through another material (e.g., air, a solid, or a liquid).		What is Sound? The Ear and Hearing
2. Demonstrate how the loudness, pitch and quality/timbre of sound can be varied.		What is Sound?
3. Design and conduct investigations to determine factors that affect pitch.		What is Sound?
4. Describe the properties of materials that reflect or absorb sound.		Speed of Sound
5. <i>Construct simple musical instruments (e.g., rubber band guitars, drums, etc.) that produce sounds with various pitches, volume and timbres.</i>		-
CMT: B17. Describe the factors that affect the pitch and loudness of sound produced by vibrating objects.		What is Sound?
CMT: B18. Describe how sound is transmitted, reflected and/or absorbed by different materials.		What is Sound? Speed of Sound
5.1.b. Light is a form of energy that travels in a straight line and can be reflected by a mirror, refracted by a lens, or absorbed by objects.		
1. <i>Provide evidence that light travels in straight lines away from a source in all directions.</i>		-
2. Investigate how light is refracted as it passes through a lens or through one transparent material to another.		Refraction
3. Demonstrate that white light is composed of many colors.		Color
4. Explain that all visible objects are reflecting some light to the human eye.		What is Light?
5. Contrast the way light is reflected by smooth, shiny objects (e.g., mirror or pool of water) and how it is reflected by other objects.		Reflection
6. Measure angles to predict the path of light reflected by a mirror.		Reflection
7. Determine whether a material is opaque, transparent or translucent based on how light passes through it.		What is Light?
8. <i>Design and conduct light absorption experiments that vary the size, length, direction and clarity of a shadow by changing the position of the light-blocking object or the light source.</i>		-
CMT: B19. Describe how light is absorbed and/or reflected by different surfaces.		Reflection
Structure and Function		
5.2 - Perceiving and responding to information about the environment is critical to the survival of organisms.		

5.2.a. The sense organs perceive stimuli from the environment and send signals to the brain through the nervous system.	
1. Explain the role of sensory organs in perceiving stimuli (e.g., light/dark, heat/cold, flavors, pain, etc.) and sending signals to the brain.	The Nervous System
2. Pose testable questions and design experiments to explore factors that affect human reaction time.	The Nervous System
3. <i>Conduct simple tests to explore the capabilities of the human senses.</i>	–
4. Summarize nonfiction text to explain the role of the brain and spinal cord in responding to information received from the sense organs.	The Nervous System
5. Identify the major structures of the human eye, ear, nose, skin and tongue, and explain their functions.	The Nervous System The Ear and Hearing
6. Draw diagrams showing the straight path of light rays from a source to a reflecting object to the eye, allowing objects to be seen.	What is Light?
7. Describe the properties of different materials and the structures in the human eye that enable humans to perceive color.	What is Light? Color
CMT: B20. Describe how light absorption and reflection allow one to see the shapes and colors of objects.	What is Light? Reflection Color
CMT: B21. Describe the structure and function of the human senses and the signals they perceive.	The Nervous System The Ear and Hearing
Earth in the Solar System	
5.3 - Most objects in the solar system are in a regular and predictable motion.	
5.3.a. The positions of the Earth and moon relative to the sun explain the cycles of day and night, and the monthly moon phases.	
1. Explain the motion of the Earth relative to the sun that causes Earth to experience cycles of day and night.	Days, Years and Seasons
2. <i>Construct models demonstrating Earth's rotation on its axis, the moon's revolution around the Earth, and the Earth and moon revolving around the sun.</i>	–
3. Distinguish between the sun as a source of light and the moon as a reflection of that light.	The Earth, Moon and Sun
4. Observe and record the moon's appearance over time and analyze findings to describe the cyclical changes in its appearance from Earth (moon phases).	The Earth, Moon and Sun
5. Relate the moon phases to changes in the moon's position relative to the Earth and sun during its 29-day revolution around the Earth.	The Earth, Moon and Sun
CMT: B22. Explain the cause of day and night based on the rotation of Earth on its axis.	Days, Years and Seasons
CMT: B23. Describe the monthly changes in the appearance of the moon, based on the moon's orbit around the Earth.	The Earth, Moon and Sun
Science and Technology in Society	
5.4 - Humans have the capacity to build and use tools to advance the quality of their lives.	

5.4.a. Advances in technology allow individuals to acquire new information about the world.	
1. Generalize that optical tools, such as binoculars, telescopes, eyeglasses or periscopes, change the path of light by reflecting or refracting it.	Reflection
2. Construct simple periscopes and telescopes, and analyze how the placement of their lenses and mirrors affects the quality of the image formed.	–
3. Evaluate the best optical instrument to perform a given task.	–
4. Design and conduct simple investigations to determine how the shape of a lens or mirror (concave, convex, flat) affects the direction in which light rays travel.	–
5. Explain how eyeglasses or contact lenses improve vision by changing the path of light to the retina.	–
6. Analyze the similarities and differences between structures of the human eye and those of a simple camera.	–
CMT: B24. Compare and contrast the structures of the human eye with those of the camera.	–
CMT: B25. Describe the uses of different instruments, such as eyeglasses, magnifiers, periscopes and telescopes, to enhance our vision.	Reflection
Grade 6	
Properties of Matter	
6.1 - Materials can be classified as pure substances or mixtures, depending on their chemical and physical properties.	
6.1.a. Mixtures are made of combinations of elements and/or compounds, and they can be separated by using a variety of physical means.	
5. Differentiate between a mixture and an element or compound and identify examples.	Element and Compounds What is a Mixture?
6. Conduct and report on an investigation that uses physical means such as particle size, density, solubility and magnetism to separate substances in a mixture.	Separating Mixtures Chromatography
CMT: C3. Explain how mixtures can be separated by using the properties of the substances from which they are made, such as particle size, density, solubility and boiling point.	Separating Mixtures Chromatography
6.1.b. Pure substances can be either elements or compounds, and they cannot be broken down by physical means.	
1. Describe the structure of the atom and its component parts.	Atomic Structure
2. Explain that density (mass/volume) is a characteristic property that can be used to identify an element or substance.	–
3. Compare and contrast the properties of a metal (aluminum, iron, etc.) with a nonmetal (oxygen, carbon, etc.)	Metals and Nonmetals
4. Illustrate the differences in the physical and chemical properties of a molecule and the individual atoms that bonded to form that molecule.	Elements and Compounds
7. Use the patterns in the Periodic Table to locate metals, semimetals and nonmetals and to predict the general characteristics of an element.	The Periodic Table

CMT: C1. Describe the properties of common elements, such as oxygen, hydrogen, carbon, iron and aluminum.	What Are Atoms?
CMT: C2. Describe how the properties of simple compounds, such as water and table salt, are different from the properties of the elements of which they are made.	Making Compounds
Matter and Energy in Ecosystems	
6.2 - An ecosystem is composed of all the populations that are living in a certain space and the physical factors with which they interact.	
6.2.a. Populations in ecosystems are affected by biotic factors, such as other populations, and abiotic factors, such as soil and water supply.	
1. Analyze and interpret how biotic and abiotic factors interact within a given ecosystem.	Habitats
2. Design and conduct a scientific investigation to explore the porosity and permeability of soils and their ability to support different plant life.	Soil Growing Plants
5. Investigate and report on the effects of abiotic factors on a plant's ability to photosynthesize.	What is Photosynthesis?
10. Explain the impact of environmental conditions such as climate, elevation, topography or water quality on food chains.	-
CMT: C4. Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis.	What is Photosynthesis?
6.2.b. Populations in ecosystems can be categorized as producers, consumers and decomposers of organic matter.	
3. Defend the statement, "The sun is the main source of energy on Earth."	What is Photosynthesis? Feeding Types
4. Express in general terms how plants and other photosynthetic organisms use the sun's energy.	What is Photosynthesis?
6. Compare and contrast how energy and matter flow in a Connecticut ecosystem, emphasizing the interactions among producers, consumers and decomposers.	Food Chains Food Webs Pyramids of Number and Biomass
7. Identify local examples of predator-prey relationships and justify the impact of each type of population on the other.	Feeding Types
8. Create and interpret graphs that illustrate the fluctuation of populations over time.	Feeding Types
9. Distinguish a food chain from a food web and identify local examples of each.	Food Chains Food Webs
11. Predict what will happen to a population based on current trends (fires, disease, overhunting, development) and defend the prediction.	-
CMT: C5. Explain how populations are affected by predator-prey relationships	Feeding Types
CMT: C6. Describe common food webs in different Connecticut ecosystems	Food Chains Food Webs
Energy in Earth's Systems	

6.3 - Variations in the amount of the sun's energy hitting the Earth's surface affect daily and seasonal weather patterns.	
6.3.a. Local and regional weather are affected by the amount of solar energy the area receives and proximity to a large body of water.	
1. Compare the composition and structure of the Earth's atmospheric layers.	The Atmosphere
2. Demonstrate how changes in temperature, pressure, moisture and density of air affect weather patterns (e.g., air masses and air pressure.)	What is Weather?
3. Describe in writing how solar energy drives Earth's weather systems.	What is Weather?
4. Investigate and report on how the introduction of heat affects the motion of particles and the distance between them.	Heat and Temperature
5. Illustrate the transfer of energy as matter changes phase.	Changing State Changes of Matter
6. <i>Design, conduct and report in writing an investigation that reveals different substances absorb and release heat at different rates.</i>	–
7. <i>Research and give examples of heat transfer and local weather differences in Connecticut.</i>	–
8. Investigate and explain the movement of local winds, including "sea breezes" and "land breezes," based on the uneven heating of the Earth's surface and a change in air pressure.	Wind and Ocean Currents
9. Examine and explain that global winds are caused by uneven heating of the Earth's surface and the rotation of the Earth.	Wind and Ocean Currents
10. <i>Design a weather forecast based on collected weather data.</i>	–
CMT: C7. Describe the effect of heating on the movement of molecules in solids, liquids and gases.	Changing State Changes of Matter
CMT: C8. Explain how local weather conditions are related to the temperature, pressure and water content of the atmosphere and the proximity to a large body of water.	What is Weather? Wind and Ocean Currents
CMT: C9. Explain how the uneven heating of the Earth's surface causes winds.	What is Weather? Wind and Ocean Currents
Science and Technology in Society	
6.4 - <i>Water moving across and through earth materials carries with it the products of human activities.</i>	
6.4.a. <i>Most precipitation that falls on Connecticut eventually reaches Long Island Sound.</i>	
1. <i>Discuss and chart the reasons why water is essential for life.</i>	–
2. <i>Observe, analyze and record the unique physical and chemical properties of water.</i>	–
3. <i>Research the differences in quantities between fresh water (solid and liquid) and salt water covering the Earth's surface and report on the impact to humans.</i>	–
4. <i>Investigate and explain in writing how substances, both harmful and beneficial, dissolve in and are carried by surface and ground water.</i>	–
5. <i>Use appropriate maps to locate and identify the major watersheds that drain into Long Island Sound and analyze how the topography influences the way water moves in the Long Island Sound watershed.</i>	–

6. Research and evaluate in writing the effects of common point and nonpoint water pollutants in Connecticut.	–
7. Compare and contrast the general structures, processes and limitations of a septic system to a secondary wastewater treatment plant.	–
8. Debate the effectiveness of a law designed to protect water resources.	–
CMT: C10. Explain the role of septic and sewage systems on the quality of surface and ground water.	–
CMT: C11. Explain how human activity may impact water resources in Connecticut, such as ponds, rivers and the Long Island Sound ecosystem.	–
Grade 7	
7.1 - Energy provides the ability to do work and can exist in many forms.	
7.1.a. Work is the process of making objects move through the application of force.	
1. Conduct simple experiments that show and explain how forces work to change the motion of an object.	What Are Forces?
2. Calculate work done on an object as force or distance varies.	Calculating Resultant Forces
3. Explain in writing how the six simple machines make work easier but do not alter the amount of work done on an object, and demonstrate how everyday objects function as simple machines.	Moments Hydraulics
4. Determine ways to modify a simple machine (inclined plane, pulley and lever) to improve its mechanical advantage.	Moments
5. Defend the statement, "Work output of a machine is always less than work input because of energy lost due to friction."	–
6. Design and create a working compound machine from several simple machines.	–
CMT: C12. Explain the relationship among, force, distance and work, and use the relationship ($W = F \times D$) to calculate work done in lifting heavy objects.	–
CMT: C13. Explain how simple machines, such as inclined planes, pulleys and levers, are used to create mechanical advantage.	Moments
7.1.b. Energy can be stored in many forms and can be transformed into the energy of motion.	
7. Use a diagram or model of a moving object (roller coaster, pendulum, etc.) to describe the conversion of potential energy into kinetic energy and vice versa.	–
8. Discuss different forms of energy and describe how they can be converted from one form to another for use by humans (e.g., thermal, electrical, light, chemical, mechanical).	What is Energy? How is Electrical Energy Useful? Energy Changes
9. Trace energy conversions that occur in the human body once food enters and explain the conversions in writing.	Releasing Energy
10. Calculate potential and kinetic energy and relate those quantities to total energy in a system.	–
CMT: C14. Describe how different types of stored (potential) energy can be used to make objects move.	–
Structure and Function	

7.2 - Many organisms, including humans, have specialized organ systems that interact with each other to maintain dynamic internal balance.	
7.2.a. All organisms are composed of one or more cells; each cell carries on life-sustaining functions.	
2. Illustrate and describe in writing the structure and the functions of the following: cell membrane, cytoplasm, mitochondria and nucleus of an animal cell.	Animal and Plant Cells Looking at Cells
CMT: C15. Describe the basic structures of an animal cell, including the nucleus, cytoplasm, mitochondria and cell membrane, and how they function to support life.	Animal and Plant Cells Looking at Cells
7.2.b. Multicellular organisms need specialized structures and systems to perform basic life functions.	
1. Compare and contrast single-celled organisms with multicellular organisms.	Animal and Plant Cells
3. Explain how the structure and function of multicellular organisms (animals) depends on the interaction of cells, tissues, organs and organ systems.	Cells to Organisms
4. Investigate and explain in writing the basic structure and function of the human skeletal system.	The Musculoskeletal System
5. Differentiate between the structures and range of motion associated with ball, socket and hinge joints and relate human joints to simple machines.	The Musculoskeletal System
6. Demonstrate how the muscles, tendons, ligaments and bones interact to support the human body and allow movement.	The Musculoskeletal System
7. Label the major parts of the human respiratory system and explain in writing the function of each part (nasal cavity, trachea, bronchi, lungs and diaphragm).	The Respiratory System
8. Label the major parts of the human circulatory system and explain in writing the function of each part (heart, veins, arteries and capillaries).	Respiration and the Circulatory System
9. Design and conduct controlled variable experiments to analyze the interaction between the circulatory and respiratory systems as the demand for oxygen changes.	Respiration and the Circulatory System
10. Label the major parts of the human digestive system and explain in writing the function of each part in the chemical and physical breakdown of food (mouth, esophagus, stomach, small intestine, large intestine and rectum).	Digestion Chemical Digestion
CMT: C16. Describe the structures of the human digestive, respiratory and circulatory systems and explain how they function to bring oxygen and nutrients to the cells and expel waste materials.	Digestion Respiration and the Circulatory System The Respiratory System
CMT: C17. Explain how the human musculoskeletal system supports the body and allows movement.	The Musculoskeletal System
Energy in the Earth's Systems	
7.3 - Landforms are the result of the interaction of constructive and destructive forces over time.	
7.3.a. Volcanic activity and the folding and faulting of rock layers during the shifting of the Earth's crust affect the formation of mountains, ridges and valleys.	
1. Illustrate and describe in writing the composition of the three major layers of the Earth's interior.	The Structure of the Earth
2. Explain how Earth's internal energy is transferred to move tectonic plates.	What is Plate Tectonics?
3. Demonstrate the processes of folding and faulting of the Earth's crust.	Plate Boundaries

4. Correlate common geological features/events (deep sea trenches, mountains, earthquakes, volcanoes) with the location of plate boundaries.	Plate Boundaries
5. Compare geological features that result from constructive forces (e.g., mountains and ridges) with geological features that result from destructive forces (e.g., canyons and flood plains).	Plate Boundaries
6. Analyze and interpret data about the location, frequency and intensity of earthquakes.	Earthquakes
CMT: C18. Describe how folded and faulted rock layers provide evidence of gradual up and down motion of the Earth's crust.	Plate Boundaries
CMT: C20. Explain how the boundaries of tectonic plates can be inferred from the location of earthquakes and volcanoes.	Plate Boundaries Earthquakes
7.3.b. Glaciation, weathering and erosion change the Earth's surface by moving earth materials from place to place.	
7. Compare and contrast the major agents of erosion and deposition of sediments: running water, moving ice, wave action, wind and mass movement due to gravity.	Erosion, Transportation and Deposition
8. Investigate and determine how glaciers form and affect the Earth's surface as they change over time.	–
9. Distinguish between weathering and erosion.	Biological Weathering Chemical Weathering Erosion, Transportation and Deposition Physical Weathering
10. Observe and report on the geological events that are responsible for having shaped Connecticut's landscape.	–
CMT: C19. Explain how glaciation, weathering and erosion create and shape valleys and floodplains.	–
Science and Technology in Society	
7.4 - Technology allows us to improve food production and preservation, thus improving our ability to meet the nutritional needs of growing populations.	
7.4.a. Various microbes compete with humans for the same sources of food.	
1. Investigate and describe in writing different types of microbes and the environmental conditions necessary for their survival.	What Are Microbes?
2. Describe the optimum conditions for rapid bacterial growth.	–
3. Illustrate and describe the structural differences between bacterial and animal cells.	What are Microbes? Animal and Plant Cells
4. Discover and discuss how humans use bacteria to produce food and identify examples.	Uses of Microbes
5. Compare and contrast the role of bacteria in food production and food spoilage.	Uses of Microbes
6. Evaluate and report how each method of food preservation including dehydration, pickling, irradiation and refrigeration works to stop or inhibit bacterial growth and give examples of each.	–
CMT: C21. Describe how freezing, dehydration, pickling and irradiation prevent food spoilage caused by microbes.	–

Grade 8	
Forces and Motion	
8.1 - An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.	
8.1.a. The motion of an object can be described by its position, direction of motion and speed.	
1. Use appropriate tools and techniques to make observations and gather data to determine how forces, including friction, act on an object to change its position over time in relation to a fixed point of reference.	What Are Forces? Friction Gravity Calculating Resultant Forces
2. Calculate the average speed of a moving object, and distinguish between instantaneous speed and average speed of an object.	Average and Instantaneous Speed
3. Create and interpret distance-time graphs for objects moving at constant and nonconstant speeds.	Graphing Speed
4. Predict the motion of an object given the magnitude and direction of forces acting on it (net force).	Calculating Resultant Forces
CMT: C22. Calculate the average speed of a moving object and illustrate the motion of objects in graphs of distance over time.	Average and Instantaneous Speed Graphing Speed
8.1.b. An unbalanced force acting on an object changes its speed and/or direction of motion.	
5. Investigate and demonstrate how unbalanced forces cause acceleration (change in speed and/or direction of an object's motion).	Distance, Time and Speed
6. <i>Assess in writing the relationship between an object's mass and its inertia when at rest and in motion.</i>	–
7. <i>Express mathematically how the mass of an object and the force acting on it affect its acceleration.</i>	–
8. Design and conduct an experiment to determine how gravity and friction (air resistance) affect a falling object.	Friction Calculating Resultant Forces
CMT: C23. Describe the qualitative relationships among force, mass and changes in motion.	What are Forces? Distance, Time and Speed Calculating Resultant Forces
8.1.c. <i>Objects moving in circles must experience force acting toward the center.</i>	
9. <i>Illustrate how the circular motion of an object is caused by a center-seeking force (centripetal force) resulting in the object's constant acceleration.</i>	–
CMT: C24. <i>Describe the forces acting on an object moving in a circular path.</i>	–
Heredity and Evolution	
8.2 - Reproduction is a characteristic of living systems and it is essential for the continuation of every species.	
8.2.a. Heredity is the passage of genetic information from one generation to another.	
1. Relate the continued existence of any species to its successful reproduction and explain in writing the factors that contribute to successful reproduction.	Competition Evolution
2. Describe the structure, location and function of chromosomes, genes and DNA and how they relate to each other in the living cell.	Causes of Variation Genes and Alleles

3. Illustrate and chart the purpose, cell type (somatic and germ) and resulting chromosome count during cell division in mitosis and meiosis.	–
4. Identify the major structures in human male and female reproductive systems and explain where meiosis and gamete formation take place.	Human Sex Cells and Systems
5. Investigate and report on the role of hormone production as it initiates and regulates the creation of male and female germ cells from birth through adolescence and into adulthood.	The Endocrine System Puberty
6. Compare and contrast the events and processes that occur when a human egg is fertilized or not fertilized.	Human Sex Cells and Systems Puberty
7. Demonstrate the relationship of corresponding genes on pairs of chromosomes to traits inherited by offspring.	Genes and Alleles
8. Describe in writing the role of the germ cells in the formation of the human zygote and its resulting 23 pairs of chromosomes, the 23rd of which determines gender and the other 22 of which determine the characteristics of that offspring.	Causes of Variation Inheritance
<i>CMT: C25. Explain the differences in cell division in somatic and germ cells.</i>	–
CMT: C26. Describe the structure and function of the male and female human reproductive systems, including the process of egg and sperm production.	Human Sex Cells and Systems
CMT: C27. Describe how genetic information is organized in genes on chromosomes, and explain sex determination in humans.	Causes of Variation Inheritance
8.2.b. Some of the characteristics of an organism are inherited and some result from interactions with the environment.	Types of Variation
Earth in the Solar System	
8.3 - The solar system is composed of planets and other objects that orbit the sun.	
8.3.a. Gravity is the force that governs the motions of objects in the solar system.	
1. Relate the strength of gravitational force between two objects to their mass and the distance between the centers of the two objects and provide examples.	Gravity
2. Describe in writing how gravitational attraction and the inertia of objects in the solar system keep them on a predictable elliptical pathway.	–
CMT: C28. Explain the effect of gravity on the orbital movements of planets in the solar system.	Gravity
8.3.b. The motion of the Earth and moon relative to the sun causes daily, monthly and yearly cycles on Earth.	
3. Distinguish between rotation of Earth on its axis and its elliptical revolution around the sun.	Days, Years and Seasons
4. Investigate and report in writing how the Earth's revolution around the sun affects changes in daylight and seasons.	Days, Years and Seasons
5. Compare the revolution times of all the planets and relate it to their distance from the sun.	The Solar System
6. Conduct and report on an investigation that shows how the Earth's tilt on its axis and position around the sun relates to the intensity of light striking the Earth's surface.	What is Weather?
7. Use a model to demonstrate the phases of the moon relative to the position of the sun, Earth and moon.	The Earth, Moon and Sun

8. Develop a model or illustration to show the relative positions of the Earth, sun and moon during a lunar and solar eclipse and explain how those positions influence the view from Earth.	The Earth, Moon and Sun
CMT: C29. Explain how the relative motion and relative position of the sun, Earth and moon affect the seasons, phases of the moon and eclipses.	Days, Years and Seasons The Earth, Moon and Sun
Science and Technology in Society	
8.4 - <i>In the design of structures there is a need to consider factors such as function, materials, safety, cost and appearance.</i>	
8.4.a. <i>Bridges can be designed in different ways to withstand certain loads and potentially destructive forces.</i>	
1. <i>Identify the forces acting on a truss, beam and suspension bridge, including compression, tension and gravity using models, pictures or diagrams.</i>	–
2. <i>Explain in writing the advantages and disadvantages of truss, beam and suspension bridge design and visually identify each bridge.</i>	–
3. <i>Conduct an experiment to discover and report on a bridge's ability to support a load based on the interplay of tension and compression forces that result in a net force of zero.</i>	–
4. <i>Use technology to simulate how engineers plan, test and revise bridge designs given parameters including cost, time, safety and aesthetics.</i>	–
CMT: C30. <i>Explain how beam, truss and suspension bridges are designed to withstand the forces that act on them.</i>	–