

Pennsylvania Standards Grades 5 - 8
Academic Standards for Science and Technology and Engineering Education 2009

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MIDDLE SCHOOL SCIENCE	Boardworks Middle School Science Presentation
3.1. Biological Sciences	
3.1.A. Organisms and Cells	
1 Common Characteristics of Life	
3.1.6.A1. Describe the similarities and differences of major physical characteristics in plants, animals, fungi, protists, and bacteria.	Classifying Organisms
3.1.7.A1. Describe the similarities and differences of physical characteristics in diverse organisms.	Classifying Organisms
2 Energy Flow	
3.1.5.A2. Describe how life on earth depends on energy from the sun.	Feeding Types What is Photosynthesis?
3.1.6.A2. Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.	What is Photosynthesis? Feeding Types Pyramids of Number and Biomass
3.1.7.A2. Describes how organisms obtain and use energy throughout their lives.	Feeding Types Food Chains Food Webs
3 Life Cycles	
3.1.5.A3 <i>Compare and contrast the similarities and differences in life cycles of different organisms.</i>	–
3.1.7.A3. <i>Explain why the life cycles of different organisms have varied lengths.</i>	–
4 Cell Cycles	
3.1.6.A4. Recognize that all organisms are composed of cells and that many organisms are unicellular and must carry out all life functions in one cell.	Animal and Plant Cells What Are Microbes?
3.1.7.A4. Explain how cells arise from pre-existing cells.	Where Do Cells Come From?
5 Form and Function	
3.1.5.A5. Explain the concept of a cell as the basic unit of life. Compare and contrast plant and animal cells.	Animal and Plant Cells
3.1.6.A5. Describe basic structures that plants and animals have that contribute to their ability to make or find food and reproduce.	Adaptations Cells to Organisms Leaves and Glucose Types of Reproduction Human Sex Cells and Systems

3.1.7.A5. Explain how the cell is the basic structural and functional unit of living things.	Animal and Plant Cells
6 Organization	
3.1.6.A6. Identify examples of unicellular and multicellular organisms.	What Are Microbes? Classifying Organisms
3.1.7.A6. Identify the levels of organization from cell to organism.	Cells to Organisms
7 Molecular Basis of Life	
3.1.7.A7. Compare life processes (e.g. growth, digestion) at the organism level with life processes at the cellular level.	Animal and Plant Cells Cells to Organisms
8 Unifying Themes	
3.1.6.A8. SCALE - Explain why the details of most cells are visible only through a microscope.	Looking at Cells
3.1.7.A8. MODELS - Apply the appropriate models to show interactions among organisms in an environment.	Food Chains Food Webs Pyramids of Number and Biomass
3.1.8.A8. CHANGE AND CONSTANCY - Explain mechanisms organisms use to adapt to their environment.	Adaptations
3.1.B. Genetics	
1 Heredity	
3.1.5.B1. Differentiate between inherited and acquired characteristics of plants and animals	Types of Variation
3.1.7.B1. Explain how genetic instructions influence inherited traits. Identify Mendelian patterns of inheritance.	Genes and Alleles Inheritance Gregor Mendel
2 Reproduction	
3.1.7.B2. Compare sexual reproduction with asexual reproduction.	Types of Reproduction
4 Biotechnology	
3.1.7.B4. Describe how selective breeding and biotechnology can alter the genetic composition of organisms.	Selecting Characteristics
5 Unifying Themes	
3.1.7 B5. PATTERNS <i>Compare and contrast observable patterns in the physical characteristics across families, strains and species.</i>	-
3.1.C. Evolution	
1 Natural Selection	
3.1.5.C1. Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment.	Animal Behavior
3.1.6.C1. Differentiate between instinctive and learned animal behaviors that relate to survival.	Types of Animal Behavior

3.1.7.C1. Describe how natural selection is an underlying factor in a population's ability to adapt to changes.	Evolution
3.1.8.C1. Explain how reproductive success coupled with advantageous traits over many generations contributes to natural selection.	Evolution
2 Adaptation	
3.1.5.C2. Give examples of how inherited characteristics (e.g., shape of beak, length of neck, location of eyes, shape of teeth) may change over time as adaptations to changes in the environment that enable organisms to survive.	Adaptations Evolution
3.1.7.C2. Explain why the extinction of a species may occur when the environment changes.	Evolution Environmental Changes
3.1.7.C2. <i>Explain that mutations can alter a gene and are the original source of new variations in a population.</i>	–
3 Unifying Themes	
3.1.7.C3. CONSTANCY AND CHANGE - Identify evidence drawn from geology, fossils, and comparative anatomy that provides the basis for the theory of evolution.	Evolution
3.2. Physical Sciences: Chemistry and Physics	
3.2.A. Chemistry	
1 Properties of Matter	
3.2.5.A1. Describe how water can be changed from one state to another by adding or taking away heat.	Changes of Matter
3.2.6.A1. Distinguish the differences in properties of solids, liquids, and gases.	Changing State Particles in Action
3.2.6.A1. <i>Differentiate between volume and mass. Investigate that equal volumes of different substances usually have different masses.</i>	–
3.2.7.A1. Differentiate between elements, compounds, and mixtures.	Elements and Compounds What is a Mixture?
3.2.7.A1. Identify groups of elements that have similar properties.	Metals and Nonmetals The Periodic Table
3.2.7.A1. <i>Explain how materials are characterized by having a specific amount of mass in each unit of volume (density).</i>	–
2 Structure of Matter	
3.2.6.A2. Compare and contrast pure substances with mixtures.	What is a Mixture?
3.2.7.A2. Identify atoms as the basic building blocks of matter and that elements are composed of one type of atom.	What Are Atoms?
3.2.8.A2. Identify characteristics of elements derived from the periodic table.	The Periodic Table
3 Matter & Energy	
3.2.6.A3. Explain and give examples of how mass is conserved in a closed system.	Conservation of Mass

3.2.7.A3. Explain how energy transfer can affect the chemical and physical properties of matter.	Energy Changes
3.2.8.A3. Explain how changes in matter are accompanied by changes in energy.	Particles in Action Changing State Energy Changes
4 Reactions	
3.2.6.A4. Differentiate between physical changes and chemical changes.	Types of Chemical Reactions
3.2.7.A4. Describe how reactants change into products in simple chemical reactions.	Types of Chemical Reactions
3.2.8.A4. Compare and contrast physical and chemical changes in terms of products.	–
5 Unifying Themes	
3.2.6.A5. CONSTANCY AND CHANGE - Identify characteristic properties of matter that can be used to separate one substance from the other.	Metals and Nonmetals Separating Mixtures
3.2.B. Physics	
1 Force & Motion of Particles and Rigid Bodies	
3.2.5.B1. Explain how mass of an object resists change to motion.	–
3.2.6.B1. Explain how changes in motion require a force.	What Are Forces? Calculating Resultant Force
3.2.7.B1. Describe how unbalanced forces acting on an object change its velocity.	What Are Forces? Calculating Resultant Force
3.2.7.B1. Analyze how observations of displacement, velocity, and acceleration provide necessary and sufficient evidence for the existence of forces.	Distance, Time and Speed
3.2.8.B1. Explain how inertia is a measure of an object's mass.	–
3.2.8.B1. Explain how momentum is related to the forces acting on an object.	Calculating Resultant Force
2 Energy Storage and Transformations: Conservation Laws	
3.2.5.B2. Examine how energy can be transferred from one form to another.	What is Energy?
3.2.6.B2. Describe energy as a property of objects associated with heat, light, electricity, magnetism, mechanical motion, and sound.	What is Energy?
3.2.6.B2. Differentiate between potential and kinetic energy.	What is Energy?
3.2.7.B2. Describe how energy can be changed from one form to another (transformed) as it moves through a system or transferred from one system to another system.	What is Energy? How is Electrical Energy Useful?
3.2.8.B2. Identify situations where kinetic energy is transformed into potential energy, and vice versa.	–
3 Heat/Heat Transfer	
3.2.5.B3. Demonstrate how heat energy is usually a byproduct of an energy transformation.	How is Electrical Energy Useful? Energy Changes Energy Efficiency
3.2.6.B3. Give examples of how heat moves in predictable ways, normally flowing from warmer objects to cooler ones until they reach the same temperature.	Heat and Temperature

3.2.6.B3. Explain the effect of heat on particle motion by describing what happens to particles during a phase change.	Changing State Particles in Action
3.2.7.B3. Differentiate among convection, conduction, and radiation.	Conduction and Convection Radiation
3.2.7.B3. <i>Explain why heat energy consists of the random motion and vibrations of the particles of matter.</i>	–
3.2.8.B3. Explain how changes in temperature are accompanied by changes in kinetic energy.	Particles in Action Conduction and Convection
4 Electrical and Magnetic Energy	
3.2.5.B4. Demonstrate how electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced. Demonstrate how electromagnets can be made and used.	Energy Transfer in Circuits How is Electrical Energy Useful? Electromagnets Uses of Electromagnets What Are Circuits?
3.2.6.B4. Describe how electric current produces magnetic forces and how moving magnets produce electric current.	Electromagnets Uses of Electromagnets
3.2.6.B4. <i>Derive Ohm's Law through investigation of voltage, current, and resistance.</i>	–
3.2.7.B4. Explain how electrical current is produced by the flow of electrons.	What Are Circuits?
3.2.7.B4. Explain and demonstrate how electric current produces magnetic forces and how moving magnets produce electric current.	Electromagnets Uses of Electromagnets
3.2.8.B4. Compare and contrast atomic properties of conductors and insulators.	Conduction and Convection
5 Nature of Waves (Sound and Light Energy)	
3.2.5.B5. Compare the characteristics of sound as it is transmitted through different materials. Relate the rate of vibration to the pitch of the sound.	What is Sound? Speed of Sound
3.2.7.B5. Demonstrate that visible light is a mixture of many different colors.	Color
3.2.7.B5. Explain the construct of the electromagnetic spectrum.	Electromagnetic Waves
3.2.7.B5. Describe how sound and light energy are transmitted by waves.	What is Sound? What is Light?
6 Unifying Themes	
3.2.6.B6. ENERGY - Demonstrate that heat moves in predictable ways from warmer objects to cooler ones.	Heat and Temperature
3.2.6.B6. SCALE - Investigate that materials may be composed of parts too small to be seen without magnification.	Atomic Structure What are Atoms?
3.2.7.B6. ENERGY- Demonstrate that heat is often produced as energy is transformed through a system.	How is Electrical Energy Useful? Energy Changes Energy Efficiency
3.2.7.B6. ENERGY - Demonstrate how the transfer of heat energy causes temperature changes.	Conduction and Convection

3.2.8.B6. PATTERNS - Explain how physics principles underlie everyday phenomena and important technologies.	–
3.3. Earth and Space Sciences	
3.3.A. Earth Structure, Processes and Cycles	
1 Earth Features and the Processes that Change It	
3.3.5.A1. Describe how landforms are the result of a combination of destructive forces such as erosion and constructive erosion, deposition of sediment, etc.	Erosion, Transportation and Deposition Sedimentary Rocks
3.3.7.A1. Define basic features of the rock cycle.	The Rock Cycle
3.3.7.A1. Describe the layers of the earth.	The Structure of the Earth
3.3.7.A1. Differentiate among the mechanisms by which heat is transferred through the Earth's system.	What is Plate Tectonics?
3.3.8.A1. Distinguish between physical and chemical weathering.	Physical Weathering Chemical Weathering
3.3.8.A1. Compare and contrast the types of energy that drive Earth's systems.	–
2 Earth's Resources/Materials	
3.3.5.A2. Describe the usefulness of Earth's physical resources as raw materials for the human made world.	Fossil Fuels Nonrenewable Energy Resources Renewable Energy
3.3.7.A2. Explain land use in relation to soil type and topography.	–
3.3.8.A2. Describe renewable and nonrenewable energy resources.	Nonrenewable Energy Resources Renewable Energy
3 Earth's History	
3.3.5.A3. Explain how geological processes observed today such as erosion, movement of lithospheric plates, and changes in the composition of the atmosphere are similar to those in the past.	Erosion, Transportation and Deposition Sedimentary Rocks What is Plate Tectonics?
3.3.7.A3. Explain and give examples of how physical evidence, such as fossils and surface features of glaciation support theories that the Earth has evolved over geologic time.	–
3.3.7.A3. Compare geologic processes over time.	–
3.3.8.A3. Explain how matter on earth is conserved throughout the geological processes over time.	–
4 Water	
3.3.5.A4. Explain the basic components of the water cycle.	The Water Cycle

3.3.6.A4. Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.	The Water Cycle
3.3.7.A4. <i>Differentiate among Earth's water systems.</i>	–
3.3.7.A4. <i>Describe the motions of tides and identify their causes.</i>	–
3.3.8.A4. Explain how the oceans form one interconnected circulation system powered by wind, tides, the Earth's rotation, and water density differences.	Wind and Ocean Currents
5 Weather and Climate	
3.3.5.A5. Differentiate between weather and climate. Explain how the cycling of water, both in and out of the atmosphere, has an effect on climate.	What is Weather? Climate Zones
3.3.6.A5. Describe the composition and layers of the atmosphere.	The Atmosphere
3.3.6.A5. Explain the effects of oceans on climate.	Wind and Ocean Currents
3.3.6.A5. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.	What is Weather? Wind and Ocean Currents Precipitation
3.3.7.A5. <i>Describe basic elements of meteorology.</i>	–
3.3.7.A5. Explain the relationship between the energy provided by the sun and the temperature differences among water, land and atmosphere.	What is Weather? Wind and Ocean Currents
3.3.8.A5. Explain how the curvature of the earth contributes to climate.	What is Weather?
3.3.8.A5. <i>Compare and contrast water vapor, clouds, and humidity.</i>	–
6 Unifying Themes	
3.3.6.A6. <i>MODELS/SCALES - Describe the scales involved in characterizing Earth and its atmosphere.</i>	–
3.3.6.A6. <i>MODELS/SCALES - Create models of Earth's common physical features.</i>	The Structure of the Earth Plate Boundaries
3.3.7.A6. <i>MODELS/SCALES - Locate significant geologic structures using various mapping representations.</i>	–
3.3.7.A6. <i>CONSTANCY/ CHANGE - Describe changes in atmospheric conditions associated with various weather patterns.</i>	What is Weather? Wind and Ocean Currents
3.3.7.A6. <i>CONSTANCY/ CHANGE SCALE - Describe geologic time as it relates to earth processes.</i>	–
3.3.8.A6. <i>CHANGES - Explain changes in earth systems in terms of energy transformation and transport.</i>	–
3.3.8.A6. <i>MODELS - Explain how satellite images, models, and maps are used to identify Earth's resources.</i>	–
3.3.B. Origin and Evolution of the Universe	
1 Composition and Structure	

3.3.5.B1. Provide evidence that the earth revolves around (orbits) the sun in a year's time and that the earth rotates on its axis once approximately every 24 hours.	Days, Years and Seasons
3.3.6.B1. Compare and contrast the size, composition, and surface features of the planets that comprise the solar system as well as the objects orbiting them.	The Solar System
3.3.6.B1. Recognize the role of gravity as a force that pulls all things on or near the earth toward the center of the earth and in the formation of the solar system and the motions of objects in the solar system.	Gravity
<i>3.3.6.B1. Explain why the planets orbit the sun in nearly circular paths.</i>	–
<i>3.3.6.B1. Describe how the planets change their position relative to the background of the stars</i>	–
3.3.6.B1. Explain how the tilt of the earth and its revolution around the sun cause an uneven heating of the earth which in turn causes the seasons and weather patterns.	What is Weather?
<i>3.3.7.B1. Explain how gravity is the major force in the formation of the planets, stars, and the solar system.</i>	–
3.3.7.B1. Describe gravity as a major force in determining the motions of planets, stars, and the solar system.	Gravity
3.3.7.B1. Compare and contrast properties and conditions of objects in the solar system to those on Earth.	The Solar System
<i>3.3.8.B1. Explain how light, measured remotely, can be used to classify objects in the universe.</i>	–
3.3.6.B2. MODELS Use models to demonstrate that earth has different seasons and weather patterns.	Days, Years and Seasons Climate Zones
MODELS Use models to demonstrate that the phases of the moon are a result of its orbit around Earth.	The Earth, Moon and Sun
3.3.7.B2. SCALE AND MEASUREMENT Identify a variety of instruments used to gather evidence about the universe.	Satellites Exploring Space
PATTERNS Describe repeating patterns in the Sun- Earth-Moon system and the positions of stars.	The Earth, Moon and Sun
SCALE Relate planetary size and distance in our solar system using an appropriate scale model.	The Solar System
<i>3.3.8.B2. SCALE AND MEASUREMENT Explain measurements and evidence indicating the age of the universe.</i>	–