Virginia Middle School Science Standards, Grades 5&6

MIDDLE SCHOOL SCIENCE	Boardworks Middle School Science Presentation
GRADE 5	
Standard 5.2: The student will investigate and understand how sound is transmitted and is used as a means of communication. Key concepts include	
a) frequency, waves, wavelength, vibration;	
• use the basic terminology of sound to describe what sound is, how it is formed, how it affects matter, and how it travels.	What is Sound? Speed of Sound
• create and interpret a model or diagram of a compression wave.	What is Sound?
• explain why sound waves travel only where there is matter to transmit them.	What is Sound? Speed of Sound
• explain the relationship between frequency and pitch.	What is Sound?
• *design an investigation to determine what factors affect the pitch of a vibrating object. This includes vibrating strings, rubber bands, beakers/bottles of air and water, tubes (as in wind chimes), and other common materials.*	–
b) the ability of different media (solids, liquids, and gases) to transmit sound; and	
• compare and contrast sound traveling through a solid with sound traveling through the air. Explain how different media (solid, liquid, and gas) will affect the transmission of sound.	Speed of Sound
c) uses and applications (voice, sonar, animal sounds, and musical instruments).	
• compare and contrast how different kinds of musical instruments make sound. This includes string instruments, woodwinds, percussion instruments, and brass instruments.	What is Sound?
Standard 5.3: The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include	
a) the visible spectrum and light waves;	
• explain the relationships between wavelength and the color of light. Name the colors of the visible spectrum.	Color
• *diagram and label a representation of a light wave, including wavelength, peak, and trough.*	–
b) refraction of light through water and prisms;	
• analyze the effects of a prism on white light and describe why this occurs. Explain why a rainbow occurs.	Color
c) reflection of light from reflective surfaces (mirrors);	
• compare and contrast reflection and refraction, using water, prisms, and mirrors.	Reflection Refraction
d) opaque, transparent, and translucent; and	

• *explain the terms transparent, translucent, and opaque, and give an example of each.*	–
e) historical contributions in understanding light.	–
Standard 5.4: The student will investigate and understand that matter is anything that has mass, takes up space, and occurs as a solid, liquid, or gas. Key concepts include	
a) atoms, elements, molecules, and compounds;	
• construct and interpret models of atoms, elements, molecules, and compounds.	Atomic Structure Elements and Compounds
b) mixtures including solutions; and	
• compare and contrast mixtures and solutions, elements and compounds, and atoms and molecules.	Solutions Elements and Compounds What is a Mixture?
c) the effect of heat on the states of matter.	
• design an investigation to determine how heat affects the states of matter (e.g., water). Include in the design ways information will be recorded, what measures will be made, what instruments will be used, and ways the data will be graphed.	Changes of Matter Changing State
• construct and interpret a sequence of models (diagrams) showing the activity of molecules in all three states of matter.	Particles in Action Changing State
Standard 5.5: The student will investigate and understand that organisms are made of cells and have distinguishing characteristics. Key concepts include	
a) basic cell structures and functions;	
• draw, label, and describe the essential structures and functions of plant and animal cells. For plants, include the nucleus, cell wall, cell membrane, vacuole, chloroplasts, and cytoplasm. For animals, include the nucleus, cell membrane, vacuole, and cytoplasm.	Animal and Plant Cells
• design an investigation to make observations of cells.	Looking at Cells
• compare and contrast plant and animal cells and identify their major parts and functions.	Animal and Plant Cells
b) kingdoms of living things;	
• compare and contrast the distinguishing characteristics of the kingdoms of organisms.	Classifying Organisms
c) vascular and nonvascular plants; and	Classifying Organisms
d) vertebrates and invertebrates.	
• group organisms into categories, using their characteristics: living things (kingdoms), plants (vascular and nonvascular), and animals (vertebrates or invertebrates). Name and describe two common examples of each group.	Classifying Organisms
Standard 5.6: The student will investigate and understand characteristics of the ocean environment. Key concepts include	
a) geological characteristics (continental shelf, slope, rise);	
• *explain key terminology related to the ocean environment.*	–

• *create and interpret a model of the ocean floor and label and describe each of the major features.*	–
• *research and describe the variation in depths associated with ocean features, including the continental shelf, slope, rise, the abyssal plain, and ocean trenches.*	–
b) physical characteristics (depth, salinity, major currents); and	
• design an investigation (including models and simulations) related to physical characteristics of the ocean environment (depth, salinity, formation of waves, and currents, such as the Gulf Stream).	Wind and Ocean Currents
• *interpret graphical data related to physical characteristics of the ocean.*	–
• explain the formation of ocean currents and describe and locate the Gulf Stream.	Wind and Ocean Currents
c) biological characteristics (ecosystems).	
• design an investigation (including models and simulations) related to biologic characteristics of the ocean environment (ecological relationships).	–
• interpret graphical data related to the biological characteristics of the ocean, such as the number of organisms vs. the depth of the water.	–
• analyze how the physical characteristics (depth, salinity, and temperature) of the ocean affect where marine organism can live.	–
• create and interpret a model of a basic marine food web, including floating organisms (plankton), swimming organisms, and organisms living on the ocean bottom.	Food Chains
Standard 5.7: The student will investigate and understand how the Earth's surface is constantly changing. Key concepts include	
a) the rock cycle including identification of rock types;	
• apply basic terminology (italic print in overview) to explain how the Earth surface is constantly changing.	What is Plate Tectonics? Plate Boundaries Erosion, Transportation and Deposition
• draw and label the rock cycle and describe the major processes and rock types involved.	The Rock Cycle Igneous Rocks Metamorphic Rocks Sedimentary Rocks
• compare and contrast the origin of igneous, sedimentary, and metamorphic rocks.	Different Types of Rocks Igneous Rocks Metamorphic Rocks Sedimentary Rocks The Rock Cycle
• *identify rock samples (granite, gneiss, slate, limestone, shale, sandstone, and coal), using a rock classification key.*	–

b) Earth history and fossil evidence;	
• *make plausible inferences about changes in the Earth over time based on fossil evidence. This includes the presence of fossils of organisms in sedimentary rocks of Virginia found in the Appalachians, Piedmont, and Coastal Plain/Tidewater.*	–
c) the basic structure of the Earth's interior;	
• describe the structure of Earth in terms of its major layers - crust, mantle, and inner and outer cores - and how the Earth's interior affects the surface.	The Structure of the Earth What is Plate Tectonics?
d) plate tectonics (earthquakes and volcanoes);	
• differentiate among the three types of plate tectonic boundaries (divergent, convergent, and sliding) and how these relate to the changing surface of the Earth and the ocean floor (5.6).	Plate Boundaries
• compare and contrast the origin of earthquakes and volcanoes and how they affect the Earth's surface.	Plate Boundaries Earthquakes Igneous Rocks
e) weathering and erosion; and	
• design an investigation to locate, chart, and report weathering and erosion at home and on the school grounds. Create a plan to solve erosion problems that may be found.	Erosion, Transportation and Deposition Biological Weathering Chemical Weathering Physical Weathering
• differentiate between weathering and erosion.	Erosion, Transportation and Deposition
• *design an investigation to determine the amount and kinds of weathered rock material found in soil.*	–
f) human impact.	
• describe how people change the Earth's surface and how negative changes can be controlled.	Flooding Growing Plants Acid Rain Chemical Weathering
GRADE 6	
Standard 6.2: The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include	
a) potential and kinetic energy;	
• comprehend and apply basic terminology related to energy sources and transformations.	Renewable Energy Resources Nonrenewable Energy Resources What is Energy? How is Electrical Energy Useful?
• compare and contrast potential and kinetic energy through common examples found in the natural environment.	What is Energy?

b) the role of the sun in the formation of most energy sources on Earth;	
• design an investigation that demonstrates light energy being transformed into other forms of energy.	What is Energy? What is Photosynthesis? How is Electrical Energy Useful? Renewable Energy
c) nonrenewable energy sources (fossil fuels, including petroleum, natural gas, and coal);	
• analyze and describe the transformations of energy involved with the formation and burning of coal and other fossil fuels.	Nonrenewable Energy Resources Fossil Fuels
• chart and analyze the energy a person uses during a 24- hour period and determine the sources.	–
• analyze and describe how the United States' energy use has changed over time.	–
d) renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar); and	
• compare and contrast renewable and nonrenewable energy sources.	Renewable Energy Nonrenewable Energy Resources
• design an application of the use of solar and wind energy.	Renewable Energy
• compare and contrast energy sources in terms of their origins, how they are utilized, and their availability.	Renewable Energy Nonrenewable Energy Resources
• analyze the advantages and disadvantages of using various energy sources.	Renewable Energy Nonrenewable Energy Resources
• predict the impact of unanticipated energy shortages.	–
e) energy transformations (heat/light to mechanical, chemical, and electrical energy).	
• create and interpret a model or diagram of an energy transformation.	What is Energy? How is Electrical Energy Useful?
Standard 6.3: The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on the Earth's surface. Key concepts include	
a) the Earth's energy budget;	
• analyze and interpret a chart or diagram showing the Earth's energy budget.	–
b) the role of radiation and convection in the distribution of energy;	
• analyze, model, and explain the Greenhouse Effect in terms of the energy entering and leaving the atmosphere.	Greenhouse Gases
• comprehend and apply basic terminology related to solar energy, including wavelength; ultraviolet, visible, and infrared radiation; and reflection and absorption.	Electromagnetic Waves Reflection What is Light? Reflection
• design an investigation to determine the effect of sunlight on the heating of a surface.	–

• analyze and explain how convection currents occur and how they distribute heat energy in the atmosphere and oceans.	What is Weather? Wind and Ocean Currents
c) the motion of the atmosphere and the oceans;	Wind and Ocean Currents
d) cloud formation; and	
• analyze the role of heating and cooling in the formation of clouds.	What is Weather?
• order the sequence of events that takes place in the formation of a cloud.	–
e) the role of heat energy in weather-related phenomena including thunderstorms and hurricanes.	What is Weather? Hurricanes
Standard 6.4: The student will investigate and understand that all matter is made up of atoms. Key concepts include	
a) atoms are made up of electrons, protons, and neutrons;	
• create and interpret a simplified model of the structure of an atom.	Atomic Structure
b) atoms of any element are alike but are different from atoms of other elements;	
• compare and contrast the atomic structure of two different elements.	Atomic Structure Elements and Compounds
c) elements may be represented by chemical symbols;	
• explain that elements are represented by symbols.	Symbols for Elements
d) two or more atoms may be chemically combined;	Making Compounds
e) compounds may be represented by chemical formulas;	
• identify the name and number of each element present in a simple molecule or compound, such as oxygen, water, carbon dioxide or calcium carbonate.	Formulae of Compounds
f) chemical equations can be used to model chemical changes; and	
• model a simple chemical change with an equation and account for all atoms. Distinguish the types of elements and number of each element in the chemical equation.	Types of Chemical Reactions Balancing Equations
g) a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere	
• name some of the predominant elements found in the atmosphere, the oceans, living matter, and the Earth's crust.	What Are Atoms?
Standard 6.5: The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include	
a) water as the universal solvent;	
• design an investigation to demonstrate the ability of water to dissolve materials.	Solutions
• model and explain the shape and composition of a water molecule.	Making Compounds
• *comprehend and apply key terminology related to water and its properties and uses.*	–
b) the properties of water in all three states;	

• design an investigation to determine the relative density of liquid and solid water at various temperatures.	Changes of Matter
• *compare the relative densities of liquid and solid water.*	–
• *comprehend the adhesive and cohesive properties of water.*	–
• design an investigation to determine the effects of heat on the states of water.	Changes of Matter Changing State
• *model and explain why ice is less dense than liquid water.*	–
• relate the three states of water to the water cycle.	Changes of Matter The Water Cycle
c) the action of water in physical and chemical weathering;	
• design an investigation to model the action of acidified water on building materials such as concrete, limestone, or marble.	Chemical Weathering Acid Rain
• design an investigation to model the action of freezing water on rock material.	Physical Weathering
• chart, record, and describe evidence of chemical weathering in the local environment.	Acid Rain Chemical Weathering
d) the ability of large bodies of water to store heat and moderate climate;	
• *analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast.*	–
e) the origin and occurrence of water on Earth;	
• design an investigation to determine the presence of water in plant material (e.g., a fruit).	The Water Cycle
f) the importance of water for agriculture, power generation, and public health; and	
• *infer how the unique properties of water are key to the life processes of organisms.*	–
• explain the role of water in power generation.	Renewable Energy
g) the importance of protecting and maintaining water resources.	
• describe the importance of careful management of water resources.	Acid Rain The Water Cycle
Standard 6.6: The student will investigate and understand the properties of air and the structure and dynamics of the Earth's atmosphere. Key concepts include	
a) air as a mixture of gaseous elements and compounds;	
• identify the composition and physical characteristics of the atmosphere.	The Atmosphere
b) air pressure, temperature, and humidity;	
• comprehend and apply basic terminology related to air and the atmosphere.	The Atmosphere
• *analyze and interpret charts and graphs of the atmosphere in terms of temperature and pressure.*	–
• *measure and record air temperature, air pressure, and humidity, using appropriate units of measurement and tools.*	–

c) how the atmosphere changes with altitude;	The Atmosphere
d) natural and human-caused changes to the atmosphere;	
• analyze and explain some of the effects that natural events and human activities may have on weather, atmosphere, and climate.	Environmental Change Greenhouse Gases Weather Hazards
e) the relationship of atmospheric measures and weather conditions;	
• map the movement of cold and warm fronts and interpret their effects on observable weather conditions.	What is Weather?
• design an investigation to relate temperature, barometric pressure, and humidity to changing weather conditions.	What is Weather?
• compare and contrast cloud types and relate cloud types to weather conditions.	What is Weather?
• compare and contrast types of precipitation.	Precipitation
• compare and contrast weather-related phenomena, including thunderstorms, tornadoes, hurricanes, and drought.	Weather Hazards Tornados Hurricanes Flooding
f) basic information from weather maps including fronts, systems, and basic measurements; and	
• interpret basic weather maps and make forecasts based on the information presented.	What is Weather?
g) the importance of protecting and maintaining air quality.	
• evaluate their own roles in protecting air quality.	–
Standard 6.7: The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include	
a) the health of ecosystems and the abiotic factors of a watershed;	
• comprehend and apply basic terminology related to watersheds.	–
• explain the factors that affect water quality in a watershed and how those factors can affect an ecosystem.	Environmental Change Acid Rain Food Webs
b) the location and structure of Virginia's regional watershed systems;	
• use topographic maps to determine the location and size of Virginia's regional watershed systems.	–
• locate their own local watershed and the rivers and streams associated with it.	–
• design an investigation to model the effects of stream flow on various slopes.	–
c) divides, tributaries, river systems, and river and stream processes;	–
d) wetlands;	
• analyze and explain the functioning of wetlands and appraise the value of wetlands to humans.	
• describe an example of a wetland.	–

e) estuaries;	
• *explain what an estuary is and why it is important to people.*	–
f) major conservation, health, and safety issues associated with watersheds; and	
• *forecast potential water-related issues that may become important in the future.*	–
• *argue for and against commercially developing a parcel of land containing a large wetland area. Design and defend a land-use model that minimizes negative impact.*	–
g) water monitoring and analysis using field equipment including hand-held technology.	
• *locate and critique a media article or editorial (print or electronic) concerning water use or water quality. Analyze and evaluate the science concepts involved.*	–
• *propose ways to maintain water quality within a watershed.*	–
• *measure, record, and analyze a variety of water quality indicators and describe what they mean.*	–
Standard 6.8: The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include	
a) the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;	
• design and interpret a scale model of the solar system. (A scale model may be a physical representation of an object or concept. It can also be a mathematical representation that uses factors such as ratios, proportions, and percentages.)	The Solar System
b) relative size of and distance between planets;	
• describe the nine planets and their relative positions from the sun.	The Solar System
c) the role of gravity;	
• explain the role of gravity in the solar system.	Gravity
d) revolution and rotation;	
• compare and contrast revolution and rotation and apply these terms to the relative movements of planets and their moons.	Days, Years and Seasons
e) the mechanics of day and night and the phases of the moon;	
• model and describe how day and night and the phases of the moon occur.	The Earth, Moon and Sun Days, Years and Seasons
f) the unique properties of Earth as a planet;	
• describe the unique characteristics of planet Earth.	The Solar System
g) the relationship of the Earth's tilt and the seasons;	
• model and describe how the Earth's axial tilt and its annual orbit around the sun cause the seasons.	Days, Years and Seasons
h) the cause of tides; and	
• *discuss the relationship between the gravitational pull of the moon and the cycle of tides.*	–
i) the history and technology of space exploration.	

• compare and contrast the ideas of Ptolemy, Aristotle, Copernicus, and Galileo related to the solar system.	The Solar System
• create and interpret a timeline highlighting the advancements in solar system exploration over the past half century. This should include information on the first modern rockets, artificial satellites, orbital missions, missions to the moon, Mars robotic explorers, and exploration of the outer planets.	Exploring Space
Standard 6.9: The student will investigate and understand public policy decisions relating to the environment. Key concepts include	
a) management of renewable resources (water, air, soil, plant life, animal life);	
• differentiate between renewable and nonrenewable resources.	Renewable Energy Nonrenewable Energy Resources
• analyze how renewable and nonrenewable resources are used and managed within the home, school, and community.	Renewable Energy Nonrenewable Energy Resources Reducing Our Energy Bills
b) management of nonrenewable resources (coal, oil, natural gas, nuclear power, mineral resources);	Nonrenewable Energy Resources Fossil Fuels
c) the mitigation of land-use and environmental hazards through preventive measures; and	–
d) cost/benefit tradeoffs in conservation policies.	
• describe the role of local and state conservation professionals in managing natural resources. These include wildlife protection; forestry and waste management; and air, water, and soil conservation.	Growing Plants Acid Rain Greenhouse Gases
• analyze resource-use options in everyday activities and determine how personal choices have costs and benefits related to the generation of waste.	Reducing Our Energy Bills
• *analyze reports, media articles, and other narrative materials related to waste management and resource use to determine various perspectives concerning the costs/benefits in real-life situations.*	–
• evaluate the impact of resource use, waste management, and pollution prevention in the school and home environment.	Reducing Our Energy Bills