Overview of Science Units & Major Resources:
GRADE 6

Unit 1: Physical Science – Matter

- Grade 6 Harcourt Science
- Kids Discover "Matter"

Unit 2: Physical Science – Energy

- Grade 6 Harcourt Science
- Kids Discover "Energy"
- Kids Discover "Light"
- Kids Discover "Bridges"
- Kids Discover "Inventions"

Unit 3: Physical Science – Forces and Motion

- Grade 6 Harcourt Science
- Interact "Skateboard" Unit
- Kids Discover "Bridges"
- Kids Discover "Inventions"

** See Science Curriculum Frameworks for more detailed information.*

** See grade level district shared folder for additional resources.*

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 1: PHYSICAL SCIENCE – MATTER

Big Questions	Formative/Summative Assessments (To be determined by teachers/teams)
1. What are the physical properties of matter? 2. How do phase changes occur? 3. What are mixtures and solutions?	Options include, but are not limited to: • Grade 6 Harcourt Science: "Atoms, Elements, and Compounds and Matter" Assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency (To be determined by teachers/teams)	Resources	Optional Ideas for Engineering Connections
Substrand: Matter. Standard: Understand that pure substances can be identified by properties which are independent of the sample of the substance and the properties can be explained by a model of matter that is composed of small particles.	Explain density, dissolving, compression, diffusion and thermal expansion using the particle model of matter. *(Standard PS: 6.2.1.1.1)*	• Diagrams will be limited to common representations of particles (e.g., dots). • Items may require students to explain common phenomena using the particle model of matter (e.g., expansion and contraction of air and solids with temperature changes, dissolving of salt in water). • Items may require students to explain how the spacing of particles affects density. • Items assessing this benchmark may also assess benchmark 6.2.1.2.3.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 1 – Atoms, Elements and Compounds (Lesson 1) Chapter 3 – Energy (Lesson 1), E72-81 Kids Discover "Matter"	
Substrand: Matter. Standard: Understand that substances can undergo physical changes which do not change the composition or the total mass of the substance in a closed system.	Identify evidence of physical changes, including changing phase or shape, and dissolving in other materials. *(Standard PS: 6.2.1.2.1)*	• Evidence is limited to changing phase or shape and dissolving in other materials.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 2 – Matter: Properties and Changes (Lessons 1, 2 and 3), E42-71	

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 1: PHYSICAL SCIENCE – MATTER (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams))	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Matter. Standard: Understand that substances can undergo physical changes which do not change the composition or the total mass of the substance in a closed system.	Describe how mass is conserved during a physical change in a closed system. (For example: The mass of an ice cube does not change when it melts.) *(Standard PS: 6.2.1.2.2)*	• Items will require students to demonstrate a conceptual understanding of physical changes in terms of mass before and after a change. • Items may require students to recognize that when an object's shape changes, its mass remains constant, and the mass of an object is the same as the mass of the sum of the pieces of that object. • Items assessing this benchmark may also assess benchmark 8.2.1.2.3.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 2 – Matter: Properties and Changes (Lesson 1), E2-11	
Substrand: Matter. Standard: Understand that substances can undergo physical changes which do not change the composition or the total mass of the substance in a closed system.	Use the relationship between heat and the motion and arrangement of particles in solids, liquids and gases to explain melting, freezing, condensation and evaporation. *(Standard PS: 6.2.1.2.3)*	• Particle diagrams are limited to common representations of particles (e.g., dots). • Items will NOT use the terms latent heat or intermolecular forces. • Items will NOT address the expansion of water when it freezes. • Items assessing this benchmark may also assess benchmarks 6.2.1.1.1, 8.3.2.3.1 or 8.3.2.3.2.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 1 – Atoms, Elements and Compounds (Lesson 3), E22-40	

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 2: PHYSICAL SCIENCE – ENERGY

Big Questions	Formative/Summative Assessments (To be determined by teachers/teams)
1. What is energy? 2. What are kinetic energy and potential energy? 3. What is thermal energy? 4. What is sound energy? 5. What is light energy? 6. How do common inventions impact our daily lives?	Options include, but are not limited to: • Grade 6 Harcourt Science "Energy and Sound/Light" Assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency (To be determined by teachers/teams)	Resources	Optional Ideas for Engineering Connections
Substrand: Energy. Standard: Understand that waves involve the transfer of energy without the transfer of matter.	Describe properties of waves, including speed, wavelength, frequency and amplitude. *(Standard PS: 6.2.3.1.1)*	• Items are limited to conceptual understandings. • Items may include measurements but will NOT include calculations. • Items may require students to use the terms speed, wavelength, frequency and amplitude to compare and contrast waves.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 4 – Sound and Light (Lesson 1), E104-113 Kids Discover "Energy" and Kids Discover "Light"	
Substrand: Energy. Standard: Understand that waves involve the transfer of energy without the transfer of matter.	Explain how the vibration of particles in air and other materials results in the transfer of energy through sound waves. *(Standard PS: 6.2.3.1.2)*	• Items may require students to relate the motion of sound to density and the particle nature of matter. • Items will NOT require calculations.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 4 – Sound and Light (Lesson 2), E114-121	
Substrand: Energy. Standard: Understand that waves involve the transfer of energy without the transfer of matter.	Use wave properties of light to explain reflection, refraction and the color spectrum. *(Standard PS: 6.2.3.1.3)*	• Items may require students to apply knowledge of what happens when visible light travels through a prism. • Items will NOT include pigment mixing. • Items will NOT require students to measure angles of refraction.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 4 – Sound and Light (Lesson 3), E122-129	
Substrand: Energy. Standard: Understand that energy can be transformed within a system or transferred to other systems or the environment.	Differentiate between kinetic and potential energy and analyze situations where kinetic energy is converted to potential energy and vise versa. *(Standard PS: 6.2.3.2.1)*	• Items will NOT require calculations. • Items will disregard the effects of friction.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 3 – Energy (Lesson 1), E74-81	

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 2: PHYSICAL SCIENCE –ENERGY (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Energy. Standard: Understand that energy can be transformed within a system or transferred to other systems or the environment.	Trace the changes of energy forms, including thermal, electrical, chemical, mechanical, or others as energy is used in devices. (For example: A bicycle, light bulb, or automobile.) *(Standard PS: 6.2.3.2.2)*	• Items are limited to devices that would be familiar to middle level students in all socio-economic groups. • Additional vocabulary may include terms such as energy transformations.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 3 – Energy (Lesson 1), E74-81	Explore how motors convert electrical energy to mechanical energy and how turbines convert mechanical energy to electrical energy. Build a wind turbine – KidWind has great resources for this: http://www.kidwind.org/ *(from "The Works"*)*
Substrand: Energy. Standard: Understand that energy can be transformed within a system or transferred to other systems or the environment.	Describe how heat energy is transferred in conduction, convection, and radiation. *(Standard PS: 6.2.3.2.3)*	• Items may include common interactions in the home such as cooking; cooling or heating of beverages; home heating systems and windows. • Items may require students to apply an understanding of convection in the context of Earth science topics (e.g., weather, crustal plate movement, oceans currents, lake turnover). • Items may require students to apply an understanding of radiation in the context of Earth science (e.g., Sun and solar system, weather). • Items assessing this benchmark may also assess benchmark 8.3.2.1.3.		Grade 6 Harcourt Science: Unit E: Physical Science: Matter and Energy Chapter 3 – Energy (Lesson 1), E74-81	Challenge your students to design, build and test a solar oven. Can you cook a marshmallow in only 10 minutes on a sunny day? For inspiration, look here: http://solarcooking.org/plans/ *(from "The Works"*)*
Substrand: The Practice of Engineering. Standard: Understand that engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	**Identify a common engineered system and evaluate its impact on the daily life of humans. (For example: Refrigeration, cell phone, or automobile.)** *(Standard NSE: 6.1.2.1.1)*	• Items are limited to engineered devices, materials, structures, processes and systems that would be equally accessible to middle level students in all socio-economic groups or will provide background information for the technology.		"Wind Energy" lesson from TeachEngineering web site: http://teachengineering.org/ (in district 6th **)** Kids Discover "Bridges" and Kids Discover "Inventions"	

* "The Works" http://www.theworks.org/

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION

Big Questions	Formative/Summative Assessments (To be determined by teachers/teams)
1. What are forces? 2. How do we calculate the speed and velocity of an object? 3. How does force affect motion? 4. How are mass and weight different? 5. How does engineering impact society? 6. What is the engineering process? 7. What is the difference between an open and closed system?	Options include, but are not limited to: • Grade 6 Harcourt Science: "Forces and Motion" Assessments

Substrand/Standard	Curriculum Benchmark	MCA III Test Item Specifications	Standards of Proficiency (To be determined by teachers/teams)	Resources	Optional Ideas for Engineering Connections
Substrand: Motion. Standard: Understand that the motion of an object can be described in terms of speed, direction and change of position.	Measure and calculate the speed of an object that is traveling in a straight line. *(Standard PS: 6.2.2.1.1)*	• Items will use only one reference point (e.g., the ground, a post, a person). • Items will NOT include velocity or vectors. • No algebraic manipulation of equations will be required. • Items will only require calculating speed from distance and time, NOT distance and time from speed. • Items assessing this benchmark may also assess benchmark 6.1.3.4.1.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lesson 2), F12-21	
Substrand: Motion. Standard: Understand that the motion of an object can be described in terms of speed, direction and change of position.	For an object traveling in a straight line, graph the object's position as a function of time, and its speed as a function of time. Explain how these graphs describe the object's motion. *(Standard PS: 6.2.2.1.2)*	• Graphs are limited to line graphs; items may include constructing and analyzing line graphs from a set of data. • Items that require students to graph the object's position will provide axes labels on the graph. • Items will NOT include the term acceleration. • Items will NOT require students to make a speed versus time graph from a position versus time graph or make comparisons between those graphs. • Items assessing this benchmark may also assess benchmark 6.1.3.4.1.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lesson 2 add graphing), F12-21	

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Motion. Standard: Understand that forces have magnitude and direction and affect the motion of objects.	Recognize that when the forces acting on an object are balanced, the object remains at rest or continues to move at a constant speed in a straight line, and that unbalanced forces cause a change in the speed or direction of the motion of an object. *(Standard PS: 6.2.2.2.1)*	• Items will describe the action of forces as pushes or pulls. • Items will NOT require the identification of a specific law of motion (e.g., Newton's Laws). • Items will NOT include velocity or vectors. • Items will address the concepts qualitatively; items will NOT include the calculation of acceleration or net forces.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lesson 3), F22-29	
Substrand: Motion. Standard: Understand that forces have magnitude and direction and affect the motion of objects.	Identify the forces acting on an object and describe how the sum of the forces affects the motion of the object. (For example: Forces acting on a book on a table or a car on the road.) *(Standard PS: 6.2.2.2.2)*	• Items will describe the action of forces as pushes or pulls. • Items will NOT require the identification of a specific law of motion (e.g., Newton's Laws). • Items will address the concepts qualitatively; items will NOT include the calculation of acceleration or net forces. • Items will include forces in a single dimension. • Items may use vectors qualitatively.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lessons 1, 2 and 3), F4-29	
Substrand: Motion. Standard: Understand that forces have magnitude and direction and affect the motion of objects.	Recognize that some forces between objects act when the objects are in direct contact and others, such as magnetic, electrical, and gravitational forces can act from a distance. *(Standard PS: 6.2.2.2.3)*	• Items will NOT include the cause of electric currents in terms of electrons. • Items will NOT compare how strength of force varies over distance. • Items will NOT address the differences between attraction and repulsion in electrical and magnetic forces.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lesson 1), F4-11	

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Motion. Standard: Understand that forces have magnitude and direction and affect the motion of objects.	Distinguish between mass and weight. *(Standard PS: 6.2.2.2.4)*	• Items will NOT require calculations. • Items assessing this benchmark may also assess benchmark 8.3.3.1.3.		Grade 6 Harcourt Science: Unit F: Physical Science: Forces and Machines Chapter 1 – Forces and Motion (Lesson 1), F4-11	
Substrand: The Practice of Engineering. Standard: Understand that engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	**Recognize that there is no perfect design and that new technologies have consequences that may increase some risks and decrease others. (For example: Seat belts and airbags.)** *(Standard NSE: 6.1.2.1.2)*	• Items are limited to engineered devices and materials, structures, processes and systems that would be equally accessible to middle level students in all socio-economic groups or will provide background information for the technology.		Interact: Skateboard Unit Kids Discover "Bridges" and Kids Discover "Inventions"	One example of this is the harmful effects that some new technologies can have on the environment. With your students, discuss the benefits of quick car and plane travel vs. the cost of releasing CO2 into the atmosphere. Another example to explore is medicine. Some medications might be effective but very expensive and hard to obtain, while others that are cheaper might not be as effective, or might have unpleasant side effects. *(from "The Works"*)*
Substrand: The Practice of Engineering. Standard: Understand that engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	**Describe the trade-offs in using manufactured products in terms of features, performance, durability and cost.** *(Standard NSE: 6.1.2.1.3)*	• Items are limited to engineered devices, materials and structures that would be equally accessible to middle level students in all socio-economic groups or will provide background information for the technology. • Items may include differences between two different manufactured products such as an incandescent lightbulb and a compact fluorescent or the differences between using a pen versus a pencil.		Interact: Skateboard Unit	

* "The Works" http://www.theworks.org/

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: The Practice of Engineering. Standard: Understand that engineers create, develop and manufacture machines, structures, processes and systems that impact society and may make humans more productive.	**Explain the importance of learning from past failures, in order to inform future designs of similar products or systems. (For example: Space shuttle or bridge design.)** *(Standard NSE: 6.1.2.1.4)*	• Items will include any necessary background knowledge about the system that failed. • Items may be based on actual case studies of past engineering failures.		Interact: Skateboard Unit Kids Discover "Bridges" and Kids Discover "Inventions"	Engineers always learn from others - that's part of the engineering design process. With your students, learn about the failure of the Tacoma Narrows Bridge ("Gal-loping Gertie"). Engineers learned a lot from this disaster. Also check out the book *Fantastic Feats and Failures* written by the editors of YES Mag. *(from "The Works"*)*
Substrand: The Practice of Engineering Standard: Understand that engineering design is the process of devising products, processes and systems that address a need, capitalize on an opportunity, or solve a specific problem.	**Apply and document an engineering design process that includes identifying criteria and constraints, making representations, testing and evaluation, and refining the design as needed to construct a product or system to solve a problem. (For example: Investigate how energy changes from one form to another by designing and constructing a simple roller coaster for a marble.)** *(Standard NSE: 6.1.2.2.1)*	• Items may require students to evaluate the feasibility of the representations, recognize the iterative nature of the design process, identify potential design changes or identify criteria and constraints. • Items assessing this benchmark may also assess benchmark 8.1.3.3.3.		Grade 6 Harcourt Science: Unit F: Forces and Machines Chapter 1 – Forces and Motion (Egg Drop Activity)	These steps are often referred to as the engineering design process. See a diagram of this process on The Works' website, www.theworks.org, under the "Teachers" tab. See Teaching Resources on The Works' website for many ideas for more engineering challenges. Design Squad has many excellent challenges that you can download for free. *(from "The Works"*)*

GRADE 6: SCIENCE CURRICULUM FRAMEWORKS

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Interactions Among Science, Technology, Engineering, mathematics and Society. Standard: Understand that designed and natural systems exist in the world. These systems consist of components that act within the system and interact with other systems.	**Describe a system in terms of its subsystems and parts, as well as its inputs, processes and outputs**. *(Standard NSE: 6.1.3.1.1)*	• Items are limited to designed or natural systems related to grades 6-8 benchmarks in physical science, life science or Earth science content standards. • Items may require students to label the components of a system. • Items will provide background knowledge needed for knowing the system in order to identify subsystems, parts, inputs, processes and outputs. • Items will NOT require prior knowledge of the system.		Interact: Skateboard Unit	Sixth graders can take apart complex machines such VCRs, computers, keyboards, telephones, etc. A lot of websites can tell you what you will find inside those gadgets. For example, check out: http://www.howstuffworks.com/vcr.htm Be sure to recycle the circuit board properly. *(from "The Works"*)*
Substrand: Interactions Among Science, Technology, Engineering, mathematics and Society. Standard: Understand that designed and natural systems exist in the world. These systems consist of components that act within the system and interact with other systems.	**Distinguish between open and closed systems.** *(Standard NSE: 6.1.3.1.2)*	• Items will distinguish between open and closed systems in terms of the flow of energy and matter inside or outside of the system. • Items will NOT require students to identify whether a system is open or closed.		Interact: Skateboard Unit	
Substrand: Interactions Among Science, Technology, Engineering, Mathematics and Society. Standard: Understand that current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.	**Determine and use appropriate safe procedures, tools, measurements, graphs, and mathematical analyses to describe and investigate natural and designed systems in a physical science context.** *(Standard NSE: 6.1.3.4.1)*	• Examples of tools include a Celsius thermometer, metric ruler, timer, electronic balance and graduated cylinder. • Items may require students to determine the tool used to accurately measure a particular quantity. • Items may include constructing and analyzing line graphs from a set of data. • Mathematical analyses are limited to mean, median, range and use of mathematical equations; no algebraic manipulation of equations will be required.		Interact: Skateboard Unit	

* "The Works" http://www.theworks.org/

UNIT 3: PHYSICAL SCIENCE – FORCES AND MOTION (continued)					
Substrand/Standard	**Curriculum Benchmark**	**MCA III Test Item Specifications**	**Standards of Proficiency** (To be determined by teachers/teams)	**Resources**	**Optional Ideas for Engineering Connections**
Substrand: Interactions Among Science, Technology, Engineering, Mathematics and Society. Standard: Understand that current and emerging technologies have enabled humans to develop and use models to understand and communicate how natural and designed systems work and interact.	**Demonstrate the conversion of units within the International System of Units (SI, or metric) and estimate the magnitude of common objects and quantities using metric units.** *(Standard NSE: 6.1.3.4.2)*	• Metric prefixes are limited to kilo-, centi- and milli-. • Items are limited to mass, volume, length, time and temperature (in degrees Celsius).		Interact: Skateboard Unit	