Grade 7 Science Yearlong Curriculum Plan

Last modified: June 2016

SUMMARY

This curriculum plan is divided into four academic quarters. In Quarter 1, students explore the rules of physical science with an emphasis on the role of energy in creating systems. Quarter 2 focuses on life and body systems, as well as how matter cycles among organisms and ecosystems. Quarter 3 dives deeper into systems and cycles within ecosystems. In Quarter 4, students finish the year with Earth systems through investigating the popular topic of catastrophic Earth and weather events.

How to Use This Yearlong Plan

This yearlong plan (YLP) document, created by teachers and other curriculum leaders throughout the five districts, provides many of the pieces you need to begin planning your school year.

This document includes:

- A **yearlong map** divided into four (4) quarters that shows when standards should be taught
- A **standards overview** from the state outlining the main categories of the content-area standards as well as general practice standards
- **Block-by-block maps** with additional details of the standards, assessment information when possible and suggested Understanding by Design (UbD) units
- A **guiding document** to help teachers see the 5DP vision for science integration across domains.

FREQUENTLY ASKED QUESTIONS

1. ***Does this mean I no longer have freedom to decide how to plan my year?***
The 5DP's goal is to generally align curriculum for the sake of our highly mobile student population. The goal is to create a cohesive learning environment and provide teachers with more opportunities to collaborate, not dictate lesson plans.

2. ***Are there pacing guides? How long should I spend on each standard?***
Some districts have created pacing guides with suggested time frames. Many of these documents are available on the 5DP Server (www.5districts.com/5dp) under the district-specific documents. If your pacing guides are not posted, please discuss with your curriculum director.

3. ***Will this plan align with my textbook and other content resources?***
It is unlikely that these will align perfectly with any textbook or resource. This YLP was created with no specific textbook in mind and with the understanding that it needed to work for all five districts, each of which has unique resources. Newer textbooks are better aligned to Common Core standards but may not follow the order of this YLP. Check the 5DP Server to see if your school has created supporting documents to help you match resources to standards.

4. ***The end of the year (May & June) has less guidance in some of these yearlong plans. How should I be using that time?***
This was done purposely to allow teachers to assess their students' needs during this period. The 5DP has created a supporting document (see "End-of-Year Planning: Ideas to Finish the Year Strongly" found on the 5DP website's Resources page) to help teachers think through the best use of this time.

GRADE 7 SCIENCE STANDARDS OVERVIEW				
SCIENCE, TECHNOLOGY & ENGINEERING STANDARDS	**Q1**	**Q2**	**Q3**	**Q4**
Earth's Systems				
MS-ESS2-2				X
MS-ESS2-4		X		
Earth and Human Activity				
MS-ESS3-2				X
MS-ESS3-4				X
From Molecules to Organisms: Structures and Processes				
MS-LS1-4			X	
Ecosystems: Interactions, Energy and Dynamics				
MS-LS2-1			X	
MS-LS2-2			X	
MS-LS2-3		X		
MS-LS2-4			X	
MS-LS2-5			X	
MS-LS2-6			X	
Motion and Stability: Forces and Interactions				
MS-PS2-3		X		
MS-PS2-5		X		
Energy				
MS-PS3-1	X			
MS-PS3-2	X			
MS-PS3-3	X			
MS-PS3-4	X			
MS-PS3-5	X			
MS-PS3-6	X			
MS-PS3-7	X			
Engineering Design				
MS-ETS1-2		X		
MS-ETS1-4	X			
MS-ETS1-7(MA)				X
Technological Systems				
MS-ETS3-1(MA)		X		
MS-ETS3-2(MA)				X
MS-ETS3-3(MA)	X			
MS-ETS3-4(MA)		X		
MS-ETS3-5(MA)	X			

Science Standards Overview

GRADE 7: SYSTEMS AND CYCLES

Students in grade 7 focus on systems and cycles to build a systems perspective using their understanding of structures and elements developed in earlier grades. A focus on systems requires students to interpret information and apply concepts and skills in the broad context of the discipline, and thus make connections between different domains of knowledge. Standards in grade 7 highlight interdisciplinary connections within and across domains since most natural and designed systems and cycles are complex and interactive. Students begin a process of building expert knowledge, moving from a more concrete to an abstract perspective and creating a foundation for exploring cause and effect relationships in more depth in grade 8. They have experience in observing structure of cells, body systems, matter, the Earth, measuring changes in energy, and applying these ideas to systems and cycles that span domains.

KEY SHIFTS IN THE REVISED SCIENCE AND TECHNOLOGY/ENGINEERING (STE) STANDARDS

The STE standards are intended to drive coherent, rigorous instruction that results in student mastery and application of scientific, technological and engineering knowledge, reasoning, and skills. The revised standards reflect several key shifts from prior Massachusetts standards, a number of which reflect similar shifts in recent mathematics and ELA standards:

1. *Integration of disciplinary core ideas and practices reflect the interconnected nature of science and engineering.*

   The standards integrate disciplinary core ideas (concepts) with scientific and engineering practices (skills). Currently, Massachusetts science and technology/engineering standards focus primarily on content. The integration of rigorous concepts and practices reflects how science and engineering is applied and practiced every day and is shown to enhance student learning of both.

2. *Preparation for post-secondary success in college and careers.*

   The standards articulate key knowledge and skills students need to succeed in entry-level, credit-bearing science, engineering or technical courses in college or university; certificate or workplace training programs requiring an equivalent level of science; or comparable entry-level science or technical courses, as well as jobs and postsecondary opportunities that require scientific and technical proficiency to earn a living wage.

3. *Science and technology/engineering concepts and practices progress coherently from Pre-K to high school.*

   The standards emphasize a focused and coherent progression of knowledge and skills from grade band to grade band, allowing for a dynamic process of knowledge and skill building throughout a student's scientific education. The progression gives students the opportunity to learn more sophisticated material and re-conceptualize their understanding of how the natural and designed world works, leading to the scientific and technical understanding needed for post-secondary success.

4. *Focus on deeper understanding and application of concepts.*

   The standards are focused on a small set of disciplinary core ideas that build across grades and lead to deeper understanding and application of concepts. The standards are written to both articulate the broad concepts *and* key components that specify expected learning.

5. *Each discipline is integrated in grade-by-grade standards Pre-K to grade 8.*

   To achieve consistency across schools and districts and to facilitate collaborative work, resource sharing, and effective education for transient populations, the Pre-K to grade 8 standards are presented by grade level. All four disciplines, including earth and space science, life science, physical science, and technology/engineering are included in each grade to encourage integration across the year and through curriculum, including the use of crosscutting concepts and nature of science themes.

6. *The STE standards are coordinated with the Commonwealth's English Language Arts and Mathematics standards.*

GRADE 7 SCIENCE – QUARTER 1*	
THEME(S)	
Rules of Physical Science: Structure, transportation, energy, make-up systems in the universe	
SCIENCE, TECHNOLOGY & ENGINEERING STANDARDS	
MS-PS3-7(MA)	Describe the relationship between kinetic and potential energy and describe conversions from one form to another. [Clarification Statement: Types of kinetic energy include motion, sound, and radiation; types of potential energy include gravitational, elastic, and chemical.]
MS-PS3-4	Determine the relationships among the energy transferred, how well the type of matter retains or radiates heat, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred nor calculations of specific heat.]
MS-PS3-5	Present evidence to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of an object.] [Assessment Boundary: Does not include calculations of energy.]
MS-PS3-1	Construct and interpret data and graphs to describe the relationships among kinetic energy, mass, and speed of an object. [Clarification Statement: Examples could include riding a bicycle at different speeds and rolling different size rocks downhill.] [Assessment Boundary: Assessment is limited to relationships between kinetic energy vs. mass and kinetic energy vs. Speed separate from each other.]
MS-PS3-2	Develop a model to describe the relationship between the relative position of objects interacting at a distance and their relative potential energy in the system. [Clarification Statement: Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a stream of water. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions, and does not include calculations of potential energy.]
MS-PS3-6(MA)	Explain how thermal energy is transferred out of hotter regions or objects and into colder ones by convection, conduction and radiation.
MS-PS3-3	Apply scientific principles of energy and heat transfer to design, construct, and test a device to minimize or maximize thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred, nor account for specific heat.]
MA-ETS3-5(MA)	Use the concept of systems engineering to: a. analyze how components of a transportation, structural or communication system work together or affect each other, and b. model the inputs, processes, outputs, and feedback of a technological system.
MS-ETS3-3(MA)	Research and communicate information about how transportation systems are designed to move people and goods using a variety of vehicles and devices. Identify and describe subsystems of a transportation vehicle, including structural, propulsion, guidance, suspension, and control subsystems. [Clarification Statement: Examples of design elements include vehicle shape and cargo or passenger capacity, terminals, travel lanes, and communications/controls. Examples of vehicles can include a car, sailboat, and small airplane.]
MS-ETS1-4	Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose.

* See Guiding Document starting on page 9 for further instructions on integration of these standards.

GRADE 7 SCIENCE – QUARTER 2*	
THEME(S)	
Life Systems	
SCIENCE STANDARDS	
MS-PS2-5	Use scientific evidence to argue that fields exist between objects with mass, between magnetic objects, and between electrically charged objects that exert force on each other even though the objects are not in contact. [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]
MS-PS2-3	Describe the effect of distance and magnitude of electric charge and current on the size of electromagnetic forces. [Clarification Statement: Includes both attractive and repulsive forces.] [Assessment Boundary: Limited to proportional reasoning and algebraic thinking.]
MS-ESS2-4	Develop a model to explain how the energy of the sun and Earth's gravity drive the cycling of water, including changes of state, as it moves through multiple pathways in Earth's hydrosphere. [Clarification Statement: Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
MS-LS2-3	Develop a model to describe that matter and energy are transferred among living and nonliving parts of an ecosystem and that both matter and energy are conserved through these processes. [Clarification Statements: Cycling of matter should include the role of photosynthesis, cellular respiration, and decomposition, as well as transfer among producers, consumers (primary, secondary, and tertiary), and decomposers. Models may include food webs and food chain.] [Assessment Boundary: Cycling of specific atoms (such as carbon or oxygen), or the biochemical steps of photosynthesis, cellular respiration, and decomposition are not expected in state assessment.]
MS-ETS1-2	Evaluate competing solutions to a given design problem using a systematic process to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution.
MS-ETS3-1(MA)	Explain the function of a communication system and the role of its components, including a source, encoder, transmitter, receiver, decoder, and storage.
MS-ETS3-4(MA)	Show how the components of a structural system work together to serve a structural function or maintain and environment for a particular human use. Provide examples of physical structures and relate their design to their intended use. [Clarification Statement: Examples of uses include carrying loads and forces across a span (such as a bridge), providing livable space (such as a house or office building), or providing specific environmental conditions (such as a greenhouse or cold storage). Examples of components of a structural system could include foundation, decking, wall, roofing, inputs (such as heat or AC), and feedback mechanisms.]

* See Guiding Document starting on page 9 for further instructions on integration of these standards.

GRADE 7 SCIENCE – QUARTER 3*	
THEME(S)	
Systems in the Living World	
SCIENCE STANDARDS	
MS-LS2-2	Describe how relationships among and between organisms in an ecosystem can be competitive, predatory, parasitic, and mutually beneficial and that these interactions are found across multiple ecosystems. [Clarification Statement: Emphasis is on describing consistent patterns of interactions in different ecosystems in terms of relationships among and between organisms.]
MS-LS1-4	*(5DP note: Focus on competition leading to adaptations)* Explain, based on evidence, how characteristic animal behaviors as well as specialized plant structures increase the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of animal behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds; and, creating conditions for seed germination and growth. Examples of plant structures that affect the probability of plant reproduction could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] [Assessment Boundary: Assessment does not include natural selection.]
MS-LS2-6(MA)	Explain how changes to the biodiversity of an ecosystem—the variety of species found in the ecosystem—may limit the availability of resources humans use. [Clarification Statement: Examples of resources can include food, energy, medicine, and clean water.]
MS-LS2-1	Analyze and interpret data to provide evidence for the effects of periods of abundant and scarce resources on the growth of organisms and the number of organisms (size of populations) in an ecosystem.
MS-LS2-4	Analyze data to provide evidence that disruptions (natural or human-made) to any physical or biological component of an ecosystem can lead to shifts in all its populations. [Clarification Statement: Focus should be on ecosystems characteristics varying over time, including disruptions such as hurricanes, floods, wildfires, oil spills, and construction.]
MS-LS2-5	Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design. [Clarification Statement: Examples of design solutions could include water, land, and species protection, and the prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations]

* See Guiding Document starting on page 9 for further instructions on integration of these standards.

GRADE 7 SCIENCE – QUARTER 4*	
SCIENCE STANDARDS	
MS-ESS2-2	Construct an explanation based on evidence for how Earth's surface has changed over scales that range from microscopic to global in size and operate at times ranging from fractions of a second to billions of years. [Clarification Statement: Examples of processes occurring over large spatial and time scales include plate motion and ice ages. Examples of changes occurring over small spatial and time scales include earthquakes and seasonal weathering and erosion.]
MS-ESS3-2	Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events. [Clarification Statement: Geologic events include earthquakes, volcanic eruptions, floods, and landslides. Examples of data typically analyzed can include the locations, magnitudes, and frequencies of the natural hazards.] [Assessment Boundary: Assessment does not include analysis of data nor forecasting.]
MS-ESS3-4	Construct an argument supported by evidence that human activities and technologies can be engineered to mitigate the negative impact of increases in human population and per capita consumption of natural resources on the environment. [Clarification Statement: Arguments should be based on examining historical data such as population graphs, natural resource distribution maps, and water quality studies over time. Examples of negative impacts can include changes to the amount and quality of natural resources such as water, mineral, and energy supplies.]
MS-ETS1-7(MA)	Construct a prototype of a solution to a given design problem.
MS-ETS3-2(MA)	Compare the benefits and drawbacks of four different communication systems: radio, television, print, and internet.

* See Guiding Document starting on page 9 for further instructions on integration of these standards.

Guiding Document for Grade 7 Science

This yearlong plan (YLP) attempts to integrate standards and provide opportunities for spiraling back to content. It was built to allow for flexibility and creativity of both teacher and student. Inquiry and project-based learning and teaching are encouraged through purposeful insertion of the engineering and technology standards throughout the year.

A general note: Please refer to the Clarification Statements and Assessment Boundaries found in DESE Revised draft of the Science and Technology Standards to give you ideas for what you need to teach and what you don't need to teach. Those can be found in the block-by-block breakdown section of this document.

If you have questions about this document, feel free to reach out to your curriculum director.

QUARTER 1: FOUNDATIONS OF PHYSICAL SCIENCE, ENERGY
This term will cover the rules of Physical Science. This term should be fun and hands on. Students will be introduced to the science and engineering practices through creating models and experiments that demonstrate understanding of abstract concepts. Energy can be demonstrated and then used throughout the rest of the year when talking about, ecosystems, heat transfer, forces, etc. Three technology standards are included that utilize energy knowledge.

<u>The Plan:</u>

1. Introduce potential and kinetic energy. Types of kinetic energy include motion, sound, and radiation; types of potential energy include gravitational, elastic, and chemical. [MS-PS3-7(MA)]
2. Then discuss transfer of energy (Newton's Third law) [MS-PS3-5]
3. Heat transfer and energy changes [MS-PS3-4]
4. Graph and interpret data from an energy and speed lab [MS-PS3-1]
5. Make a model of the relationship between position and potential energy. [MS-PS3-2]
6. Thermal energy, heat transfer [MS-PS3-6(MA)]
7. Apply scientific principles of energy and heat transfer to design, construct, and test a device to minimize or maximize thermal energy transfer. [MS-PS3-3]
8. The 3 Tech & Engineering standards can be taught at teacher discretion. [MA-ETS3-5(MA), MS-ETS3-3(MA), MS-ETS1-4]

QUARTER 2: LIFE SYSTEMS

This term transitions from the physical systems covered in Quarter 1 to life systems. One benefit of this unit is that it connects the more abstract physical science of Quarter 1 with a topic students should find relatively familiar, the human body, to then transition to systems among organisms. The connecting theme of this unit is that your body is a system (made of smaller systems) and that it follows the rules of systems in physical science; additionally your body is part of the living natural world, which is also made of systems. *The MS-ESS 2-4, how does solar energy and gravity affect the hydrosphere, was moved from quarter 4 to quarter 2. The reason for this is the team felt that students having a working knowledge of the hydrosphere will aid their understanding of topics such as photosynthesis also in quarter 2 and the human impact unit in quarter 3.*

<u>The Plan:</u>

1. How physics and life science connect
2. Use photosynthesis and cellular respiration as a foundation to explain how matter cycles between organisms. [MS-LS2-3]
3. Transition from cycling of matter (Carbon, Nitrogen, Oxygen, Hydrogen, water) the roles of and relationships between organisms. [LS2-3,ESS2-4]
4. Forces lessons on Magnetism and gravity related to energy [MS-PS2-5, MS-PS2-3]
5. Communication system with source encoder, transmitter, decoder, receiver and storage and relate it to electricity[ETS3-1]
6. Components of structural system work together to serve a function [ETS3-4]

QUARTER 3: SYSTEMS IN THE LIVING WORLD

This term covers ecosystem interactions, human influences in the environment, and biodiversity. It links to Quarter 2 where you will be teaching cycles within an ecosystem and energy.

<u>The Plan:</u>

1. To start use relationships among organisms, animal behavior and plant structures as adaptations. [MS-LS2-2, MS-LS1-4]
2. Biodiversity and extinction as results of adaptations, and their relationship to human resources [MS - LS2-6]
3. Analyze data of abundance and scarcity of resources and their impacts on the growth and number of organisms [MS-LS2-1]
4. Analyze data to consider how disruptions in ecosystems affect populations. [MS-LS2-4]
5. Evaluate competing design solutions for protecting an ecosystem. Discuss benefits and limitations of each design. This connects with a similar Engineering and Technology standard regarding evaluating design solutions. [MS-LS2-5, MS-ETS1-2]

QUARTER 4: EARTH SYSTEMS

This quarter covers Earth systems that are governed by the rules of physical science. These systems could be explored through huge catastrophic events and the science behind them, including many topics popular with middle schools students: global warming, asteroid impacts, volcanoes, hurricanes and tornadoes (i.e., "Is the world going to end?"). Quarter 4 also covers the concept that humans interact with Earth systems and data and technology can be used in future decisions. Lastly, use the standard about comparing communication systems as a project about communicating solutions in different ways..

The Plan:

1. History of Earth and Patterns of catastrophic events, Geology, resource distribution [MS-ESS2-2, MS-ESS3-2, MS-ESS3-1]
2. Make a prototype. [MS-ETS1-7(MA)]
3. Compare benefits and drawbacks of communication systems. [MS-ETS3-2(MA)]
4. Construct an argument that human activities and technologies can be engineered to solve the impacts of human population and consumption of natural resources [MS-ESS3-4]

