Grade 8 Science Yearlong Curriculum Plan

Last modified: June 2016

SUMMARY

This curriculum plan is divided into four academic quarters. The overall theme for the 8th grade curriculum is that of cause and effect. Being able to analyze phenomena for evidence of causes and processes that can often not be seen and being able to conceptualize and describe them. Students start in Quarter 1 with the building blocks of matter and move to how that matter makes up life in Quarter 2. The focus of the third quarter is on the positive and negative impact humans and technology have on Earth systems. In Quarter 4, students demonstrate understanding of cause and effect through the use of models relative to the relationship between dynamic systems and cycles of Earth. In light of standardized testing, the Quarter 4 standards may be integrated into the previous three quarters.

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 8 SCIENCE STANDARDS OVERVIEW				
SCIENCE, TECHNOLOGY & ENGINEERING STANDARDS	**Q1**	**Q2**	**Q3**	**Q4***
Earth's Place in the Universe				
MS-ESS1-1b				X
MS-ESS1-2			X	
Earth's Systems				
MS-ESS2-1			X	
MS-ESS2-5			X	
MS-ESS2-6			X	
Earth and Human Activity				
MS-ESS3-1			X	
MS-ESS3-5			X	
From Molecules to Organisms: Structures and Processes				
MS-LS1-5			X	
MS-LS1-7	X			
Heredity: Inheritance and Variation of Traits				
MS-LS3-1		X		
MS-LS3-2		X		
MS-LS3-3(MA)		X		
MS-LS3-4(MA)		X		
Biological Evolution: Unity and Diversity				
MS-LS4-4		X		
MS-LS4-5		X		
Matter and Its Interactions				
MS-PS1-1	X			
MS-PS1-2	X			
MS-PS1-4	X			
MS-PS1-5		X		
Motion and Stability: Forces and Interactions				
MS-PS2-1				X
MS-PS2-2				X
Materials, Tools and Manufacturing				
MS-ETS2-4(MA)	X			
MS-ETS2-5(MA)	X			

* Quarter 4 standards should be alluded to earlier in the year so that they may be seen prior to the MCAS test, but not explicitly taught until the fourth quarter.

Science Standards Overview

GRADE 8: CAUSE AND EFFECT

Grade 8 students use more robust abstract thinking skills to explain causes of the more complex phenomena and systems. Many causes are not immediately or physically visible to students. Students wrestle with the "why" of science, to deal with unseen mechanisms at work, to make predictions about future events, and to explain patterns. In grade 8 these include, for example, causes of seasons and tides, causes of plate tectonics and weather or climate, the role of genetics in heredity and natural selection, and understanding interactions of atoms and molecules (from a more general particulate model in prior grades). Being able to analyze phenomena for evidence of causes and processes that often cannot be seen, and being able to conceptualize and describe those, is a significant cognitive transition for students in grade 8.

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 8 SCIENCE – QUARTER 1*		
SCIENCE STANDARDS		**NOTES**
MS-LS1-7	Describe that food molecules, including carbohydrates, proteins and fats, are broken down and rearranged through chemical reactions forming new molecules that support growth and/or release of energy. [Clarification Statement: Emphasis is on describing that molecules are broken apart and rearranged and that in these processes result in cell growth and energy release.] [Assessment Boundary: Assessment does not include details of the chemical reactions for respiration, biochemical steps of breaking down food, or the resulting molecules (e.g., carbohydrates are broken down into monosaccharides).]	
MS-PS1-1	Develop a model to describe that (a) atoms combine in a multitude of ways to produce pure substances which make up all of the living and nonliving things that we encounter, (b) atoms form molecules and compounds that range in size from two to thousands of atoms, and (c) mixtures are composed of different proportions of pure substances. [Clarification Statement: Examples of molecular-level models could include drawings, three-dimensional ball and stick structures, and computer representations showing different molecules with different types of atoms.][State Assessment Boundary: Valence electrons and bonding energy, the ionic nature of subunits of complex structures, complete depictions of all individual atoms in a complex molecule or extended structure, or calculations of proportions in mixtures are not expected in state assessment.]	
MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with HCl. Properties of substances include: density, melting point, boiling point, solubility, flammability, and odor.]	
MS-PS1-4	Develop a model that describes and predicts changes in particle motion, relative spatial arrangement, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of pure substances could include water, carbon dioxide, and helium.]	
MS-PS1-5	Use a model to explain that substances are rearranged during a chemical reaction to form new molecules with new properties. Explain that the atoms present in the reactants are all present in the products and thus the total number of atoms is conserved. [Clarification Statement: Examples of models can include physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]	
MS-ETS2-4(MA)	Use informational text to illustrate that materials maintain their composition under various kinds of physical processing; however, some material properties may change if a process changes the particulate structure of a material. [Clarification Statement: Examples of physical processing can include cutting, forming, extruding, and sanding. Examples of changes in material properties can include a non-magnetic iron material becoming magnetic after hammering or a plastic material becoming rigid (less elastic) after heat treatment.]	
MS-ETS2-5(MA)	Present information that illustrates how a product can be created using basic processes and manufacturing systems, including forming, separating, conditioning, assembling, finishing, quality control, and safety. Compare the advantages and disadvantages of humans vs. computer control of these processes.	

* See Guiding Document on page 10 for further instructions on integration of these standards.

GRADE 8 SCIENCE – QUARTER 2*		
SCIENCE STANDARDS		**NOTES**
MS-LS3-1	Develop and use a model to describe that structural changes to genes (mutations) may or may not result in changes to proteins, and if there are changes to proteins there may be harmful, beneficial, or neutral changes to traits. [Clarification Statement: An example of a beneficial change to the organism may be a strain of bacteria becoming resistant to an antibiotic. A harmful change could be the development of cancer; a neutral change may change the hair color of an organism with no direct consequence.] [Assessment Boundary: Assessment does not include specific changes at the molecular level (e.g., amino acid sequence change), mechanisms for protein synthesis, or specific types of mutations.]	
MS-LS3-2	Develop and use a model to describe how asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. Compare and contrast advantages and disadvantages of asexual and sexual reproduction. [Clarification Statement: Examples of models can include Punnett squares, diagrams, and simulations. Examples of an advantage of sexual reproduction can include genetic variation when the environment changes or a disease is introduced, while examples of an advantage of asexual reproduction can include not using energy to find a mate and fast reproduction rates. Examples of a disadvantage of sexual reproduction can include using resources to find a mate, while a disadvantage in asexual reproduction can be the lack of genetic variation when the environment changes or a disease is introduced.]	Can be tied to Earth Science standards that will not be explicitly covered until Quarter 4.
MS-LS3-3(MA)	Communicate through writing and in diagrams that chromosomes contain many distinct genes, and that each chromosome pair contains two alleles that can be the same or different from each other. Illustrate that each gene holds the instructions for the production of specific proteins, which in turn affects the traits of an individual. [Assessment Boundary: Assessment does not include specific changes at the molecular level or mechanisms for protein synthesis.]	
MS-LS3-4(MA)	Develop and use a model to show that in sexually reproducing organisms individuals have two of each chromosome, and hence two alleles of each gene, one acquired (randomly) from each parent. [Clarification Statement: Examples of models can include Punnett squares, diagrams, and simulations.] [Assessment Boundary: Assessment should only include dominant-recessive pattern of inheritance.]	Possible connections to math (probability and graphing)
MS-LS4-5	Synthesize and communicate information about artificial selection, or the ways in which humans have changed the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, and gene therapy).]	Can be tied to Earth Science standards that will not be explicitly covered until Quarter 4.
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include the genes responsible for size differences in different breeds of dogs, such as Great Danes and Chihuahuas. Examples of environmental factors could include drought decreasing plant growth, fertilizer increasing plant growth, and fish growing larger in large ponds than they do in small ponds. Examples of both genetic and environmental factors could include different varieties of plants growing at different rates in different conditions.] [Assessment Boundary: Assessment does not include methods of reproduction, genetic mechanisms, gene regulation, biochemical processes, or natural selection.]	
MS-LS4-4	Use a model to describe the process of natural selection, in which genetic variations of some traits in a	

	population increase some individuals' likelihood of surviving and reproducing in a changing environment. Provide evidence that natural selection occurs over many generations. [Clarification Statement: Models should include simple probability statements and proportional reasoning. Examples of evidence can include Darwin's finches, necks of giraffes, and peppered moths.] [Assessment Boundary: Specific conditions that lead to natural selection are not expected in the state assessment.]

* See Guiding Document on page 10 for further instructions on integration of these standards.

GRADE 8 SCIENCE – QUARTER 3*		
SCIENCE STANDARDS		**NOTES**
MS-ESS1-2	Explain the role of gravity in ocean tides, the orbital motions of planets, their moons, and asteroids in the solar system. [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]	
MS-ESS2-1	Develop and use a model to illustrate that energy from the Earth's interior drives convection which cycles Earth's crust leading to melting, crystallization, weathering and deformation of large rock formations, including generation of ocean sea floor at ridges, submergence of ocean sea floor at trenches, mountain building and active volcanic chains. [Clarification Statement: The emphasis is on large-scale cycling resulting from plate tectonics that includes changes in rock types through erosion, heat and pressure.] [Assessment Boundary: Assessment does not include specific mechanisms of plate tectonics, the identification and naming of minerals or rock types, nor rote memorization of the "rock cycle".]	
MS-ESS2-5	Interpret basic weather data to identify patterns in air mass interactions and the relationship of those patterns to weather. [Clarification Statement: Data includes temperature, pressure, humidity, precipitation, and wind. Examples of patterns can include air masses flow from regions of high pressure to low pressure, how sudden changes in weather can result when different air masses collide. Data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through field observations or laboratory experiments.] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]	
MS-ESS3-1	Analyze and interpret data to explain that the Earth's mineral and fossil fuel resources are unevenly distributed as a result of geologic processes. [Clarification Statement: Examples of uneven distributions of resources can include where petroleum is generally found (locations of the burial of organic marine sediments and subsequent geologic traps), and where metal ores are generally found (locations of past volcanic and hydrothermal activity).]	
MS-ESS3-5	Examine and interpret data to describe the role that human activities have played in causing the rise in global temperatures over the past century. [Clarification Statement: Examples of human activities include fossil fuel combustion, cement production, and agricultural activity. Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities.]	Ties into argument writing for ELA standards.

MS-ESS2-6	Describe how interactions involving the ocean affect weather and climate on a regional scale, including the influence of the ocean temperature as mediated by energy input from the sun and energy loss due to evaporation or redistribution via ocean currents. [Clarification Statement: Emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. A regional scale includes a state or multi-state perspective.] [Assessment Boundary: Assessment does not include Koppen Climate Classification names.]

* See Guiding Document on page 10 for further instructions on integration of these standards.

GRADE 8 SCIENCE – QUARTER 4*		
SCIENCE STANDARDS		**NOTES**
MS-ESS1-1b	Develop and use a model of the Earth-sun system to explain the cyclical pattern of seasons, which includes the Earth's tilt and differential intensity of sunlight on different areas of Earth across the year. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]	These topics may be alluded to earlier in the year so that they may be seen prior to the MCAS test, but not explicitly taught until 4th quarter.
MS-PS2-1	Develop a model that demonstrates Newton's Third Law involving the motion of two colliding objects. Assessment boundary: State assessment will be limited to vertical or horizontal interactions in one dimension.	
MS-PS2-2	Provide evidence that a change in the object's speed depends on the sum of the forces on the object (the net force) and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of force, mass, and changes in speed (Newton's Second Law) in one dimension.] [Assessment Boundaries: State assessment will be limited to forces and changes in motion in one dimension and in inertial reference frame and to change in one variable at a time. The use of trigonometry is not expected in state assessment.]	

* See Guiding Document on page 10 for further instructions on integration of these standards.

Guiding Document for Grade 8 Science

The overall theme for the 8th grade curriculum is that of cause and effect. Being able to analyze phenomena for evidence of causes and processes that can often not be seen and being able to conceptualize and describe them. We start with the building blocks of matter and move to how that matter makes up life. We then learn how that life affects our Earth. In light of standardized testing the 4th quarter standards maybe integrated into the previous three quarters.

While the strands are dictated by quarters the order and pacing is left up to the individual teachers' discretion.

QUARTER 1: BUILDING BLOCKS OF MATTER
The focus of quarter 1 is on understanding the complex properties of matter, understanding interactions of atoms and molecules from a more general particulate model than in prior grades. It is important to include examples of complex chemical reactions in living things but not limited to just biotic organisms. The breakdown of biomolecules releases energy and relate that to a machine which converts energy to do work.
Mindful suggestions:.

- Tech standard ETS 2-7 and ETS 4-1 will be revisited in 3rd quarter.

QUARTER 2: HOW MATTER MAKES LIFE
The focus of quarter 2 is on the internal and external factors that determine the traits of an organism. That an organism's traits are closely matched to their environment and how a mismatch between traits and environmental conditions impact the species as a whole. The evidence of cause and effect is present in how the building blocks of an organism are impacted by environmental factors. (genetic variation)
Mindful suggestion:

- Math can be integrated easily with these standards, specifically probability, graphing, analyzing data and identifying patterns and trends in the data.
- ESS 2-6, ESS 2-5 & ESS 2-1 can be linked to the life science standards.

QUARTER 3: HUMAN IMPACTS
The focus of the 3rd quarter is on the positive and negative impact humans and technology have on Earth systems; the role motion, energy and gravity play in driving those systems.
Mindful Suggestions:

- Revisit tech standard ETS4-1 & ETS2-7.
- Using evidence from the standards in quarter 3, students can practice argument wring to explain their models in quarter 4.
- ESS1-1b may be introduced with ESS1-2.

QUARTER 4: EARTH
The focus of the 4th quarter is on demonstrating understanding of cause and effect through the use of models relative to the relationship between dynamic systems and cycles of Earth. These standards can be introduced prior to test administration and then focused upon in greater detail.

Mindful Suggestions:

- Thermal energy, convection and density can be revisited with these standards prior to testing.
- Many of the systems discussed in grade 7 can be revisited.

