Plymouth Public Schools' Science and Technology/Engineering Program Grade 4 Integrated Science Learning Standards

An Introduction to the Massachusetts Department of Elementary and Secondary Education Science and Technology/Engineering Curriculum Framework

Effective teaching and learning in science fosters engagement and has rigor, relevance, and coherence embedded within. It couples practice with content to give the context for performance. A program with these components encourages students to analyze and explain phenomena and experience; engages with practices to build, use, and apply knowledge; and builds a storyline over time and among disciplines. The state standards that form this program are outcomes that reflect what a student should know and be able to do as a result of instruction. Science and engineering practices, which are included in these standards, are not teaching strategies; they are important learning goals and skills to be learned, also as a result of instruction. The standards listed below are not intended to represent an exhaustive list of all that could be included in our district's science program, nor should this list prevent students from going beyond the standards where appropriate. (Excerpts from Curriculum Framework)

Overarching Theme – Matter and Energy

In grade 4, students observe and interpret patterns related to the transfer of matter and energy as it relates to the different strands of science: Earth and space, life, physical, and technology/engineering. Students also interpret the patterns of how matter and energy change over time for specific purposes. For example, students explore energy in different physical contexts; changes in landscape formation; general animal structures that support life, growth, behavior, and reproduction; and the development of solutions via the engineering design process. (Excerpts from Curriculum Framework)

ESS1. Earth's Place in the Universe

4-ESS1-1. Use evidence from a given landscape that includes simple landforms and rock layers to support a claim about the role of erosion or deposition in the formation of the landscape over long periods of time.

Clarification Statements:

1. Examples of evidence and claims could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from deposition on land to deposition in water over time; and, a canyon with rock layers in the walls and a river in the bottom, indicating that a river eroded the rock over time.
2. Examples of simple landforms can include valleys, hills, mountains, plains, and canyons.

3. Focus should be on relative time.

State Assessment Boundary:
Specific details of the mechanisms of rock formation or specific rock formations and layers are not expected in state assessment.

ESS2. Earth's Systems

4-ESS2-1. Make observations and collect data to provide evidence that rocks, soils, and sediments are broken into smaller pieces through mechanical weathering and moved around through erosion by water, ice, wind, and vegetation.

Clarification Statements:
1. Mechanical weathering can include frost wedging, abrasion, and tree root wedging.
2. Erosion can include movement by blowing wind, flowing water, and moving ice.

State Assessment Boundary:
Chemical processes are not expected in state assessment.

4-ESS2-2. Analyze and interpret maps of Earth's mountain ranges, deep ocean trenches, volcanoes, and earthquake epicenters to describe patterns of these features and their locations relative to boundaries between continents and oceans.

ESS3. Earth and Human Activity

4-ESS3-1. Obtain information to describe that energy and fuels humans use are derived from natural resources and that some energy and fuel sources are renewable and some are not.

Clarification Statements:
1. Examples of renewable energy resources could include wind energy, water behind dams, tides, and sunlight.
2. Non-renewable energy resources are fossil fuels and nuclear materials.

4-ESS3-2. Evaluate different solutions to reduce the impacts of a natural event such as an earthquake, blizzard, or flood on humans.

Clarification Statement:
Examples of solutions could include an earthquake-resistant building or a constructed wetland to mediate flooding.

LS1. From Molecules to Organisms: Structures and Processes

4-LS1-1. Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior, and reproduction.

Clarification Statements:

1. Animal structures can include legs, wings, fins, feathers, trunks, claws, horns, antennae, eyes, ears, nose, heart, stomach, lung, brain, and skin.
2. Plant structures can include leaves, roots, stems, bark, branches, flowers, fruit, and seeds.

State Assessment Boundary:
State assessment will be limited to macroscopic structures

PS3. Energy

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

State Assessment Boundaries:

1. State assessment will be limited to analysis of kinetic energy.
2. Accounting for mass, quantitative measures of changes in the speed of an object, or any precise or quantitative definition of energy are not expected in state assessment.

4-PS3-2. Make observations to show that energy can be transferred from place to place by sound, light, heat, and electric currents.

Clarification Statement:
Evidence of energy being transferred can include vibrations felt a small distance from a source, a solar-powered toy that moves when placed in direct light, warming a metal object on one end and observing the other end getting warm, and a wire carrying electric energy from a battery to light a bulb.

State Assessment Boundary:
Quantitative measurements of energy are not expected in state assessment.

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement:
Changes in energy can include a change in the object's motion, position, and the generation of heat and/or sound.

State Assessment Boundary:
Analysis of forces or quantitative measurements of energy are not expected in state assessment.

4-PS3-4. Apply scientific principles of energy and motion to test and refine a device that converts kinetic energy to electrical energy or uses stored energy to cause motion or produce light or sound.

Clarification Statement:
Sources of stored energy can include water in a bucket or a weight suspended at a height, and a battery.

PS4. Waves and Their Applications in Technologies for Information Transfer

4-PS4-1. Develop a model of a simple mechanical wave (including sound) to communicate that waves:

a. are regular patterns of motion along which energy travels, and
b. can cause objects to move.

Clarification Statement:
Examples of models could include diagrams, analogies, and physical models.

State Assessment Boundary:
Interference effects, electromagnetic waves, or non-periodic waves are not expected in state assessment.

4-PS4-2. Develop a model to describe that light must reflect off an object and enter the eye for the object to be seen.

State Assessment Boundary:
Specific colors reflected and seen, the cellular mechanisms or visions, angles of incidence and reflection, or how the retina works are not expected in state assessment.

4-PS4-3. Develop and compare multiple ways to transfer information through encoding, sending, receiving, and decoding a pattern.

Clarification Statement:
Examples of solutions could include drums sending coded information through sound waves, using a grid of 1s and 0s representing black and white to send information about a picture, and using Morse code to send text.

ETS1. Engineering Design

4.3-5-ETS1-3. Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of tests to redesign a model or prototype.

Clarification Statement:
Examples of design features can include materials, size, shape, and weight.

4.3-5-ETS1-5(MA). Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.