PLTW Launch Standards Connection

Energy: Collisions

Connections to Standards in PLTW Launch

PLTW curriculum is designed to empower students to thrive in an evolving world. As a part of the design process when developing and updating our curriculum, we focus on connections to a variety of standards. This PLTW Launch module connects to standards in the following:

Next Generation Science Standards

Energy

4-PS3-1

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-3

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

Engineering Design

3-5-ETS1-1

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2

Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science and Engineering Practices: Asking Questions and Defining Problems

Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.

Science and Engineering Practices: Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

Science and Engineering Practices: Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Science and Engineering Practices: Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

Science and Engineering Practices: Using Mathematics and Computational Thinking

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

Next Generation Science Standards

Science and Engineering Practices: Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.

Disciplinary Core Ideas (3-5)

Physical Science

PS3.A Definitions of Energy

- The faster a given object is moving, the more energy it possesses.

PS3.A Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electrical currents.

PS3.B Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

PS3.C Relationship Between Energy and Forces

- When objects collide, contact forces transfer energy so as to change the objects' motions.

Engineering, Technology, and Applications of Science

ETS1.A Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1.B Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution.

ETS1.B Developing Possible Solutions

- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Next Generation Science Standards

ETS1.B Developing Possible Solutions

- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

ETS1.C Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Crosscutting Concepts (3-5)

Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.
- Patterns of change can be used to make predictions.
- Patterns can be used as evidence to support an explanation.

Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

- Cause and effect relationships are routinely identified, tested, and used to explain change.

Scale, Proportion, and Quantity – In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

- Natural objects and/or observable phenomena exist from very short to very long time periods.
- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Energy and Matter: Flows, Cycles, and Conservation – Tracking energy and matter flows, into, out of, and within systems helps one understand their system’s behavior.

- Energy can be transferred in various ways and between objects.

Computer Science Teachers Association K-12 Computer Science

In June 2018 PLTW submitted all necessary documentation required by the Computer Science Teachers Association (CSTA) for a CSTA Curriculum Task Force crosswalk review of our Launch and Gateway curricula. While we fully anticipate approval and validation by CSTA, review is still pending at this time.

Data and Analysis

Collection Visualization & Transformation

1B-DA-06

Organize and present collected data visually to highlight relationships and support a claim.

Inference & Models

1B-DA-07

Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.

International Society for Technology in Education Standards for Students

Knowledge Constructor

3a

Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.

3d

Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

Innovative Designer

4a

Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

4b

Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

4c

Students develop, test and refine prototypes as part of a cyclical design process.

4d

Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

Computational Thinker

5b

Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

5c

Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

Creative Communicator

6a

Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

6b

Students create original works or responsibly repurpose or remix digital resources into new creations.

6c

Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

International Society for Technology in Education Standards for Students

6d

Students publish or present content that customizes the message and medium for their intended audiences.

Global Collaborator

7a

Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.

7b

Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.

7c

Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

Common Core State Standards English Language Arts - Fourth Grade

Reading Informational Text Standards

Key Ideas and Details

CCSS.ELA-LITERACY.RI.4.1

Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

Key Ideas and Details

CCSS.ELA-LITERACY.RI.4.3

Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Writing Standards

Text Types and Purposes

CCSS.ELA-LITERACY.W.4.2

Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.4.8

Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

CCSS.ELA-LITERACY.W.4.9

Draw evidence from literary or informational texts to support analysis, reflection, and research.

Common Core State Standards Mathematics - Fourth Grade

Operations and Algebraic Thinking

Use the four operations with whole numbers to solve problems.

CCSS.MATH.CONTENT.4.OA.A.3

Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Mathematical Practices

CCSS.MATH.PRACTICE.MP2

Reason abstractly and quantitatively.

CCSS.MATH.PRACTICE.MP4

Model with mathematics.

CCSS.MATH.PRACTICE.MP5

Use appropriate tools strategically.

References

Computer Science Teachers Association. (2017). *CSTA K-12 Computer Science Standards, revised 2017*. http://www.csteachers.org/standards

International Society for Technology in Education. (2016). *ISTE standards for students.* http://www.iste.org/standards/for-students

National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards.* National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states.* National Academies Press.