Orange Public Schools

Office of Curriculum & Instruction

2019-2020 Mathematics Curriculum Guide

PLTW Launch

4th Grade

Curriculum Framework

September 9, 2019 – June 25, 2020

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Curriculum Framework
PLTW Launch – 4th Grade – Energy: Collisions

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="2">Standards
Next Generation Science Standards
• 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.
• PS2.A: Forces and Motion - Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.
• PS2.B: Types of Interactions - Objects in contact exert forces on each other.
• 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.
• 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 accounts.</td><td colspan="2">Transfer
Students will be able to independently use their learning to …
T1 – Evaluate a problem in a new and novel situation.
T2 – Apply a step by step design process to solve a problem.
T3 – Predict the effects of a collision.</td></tr>
<tr><td>Meaning
UNDERSTANDINGS:
Students will understand that …
• U1 – Engineers have a step by step approach for looking at and solving a problem called the design process.
• U2 – Engineers and designers create new products and technology to meet a need or want that meets specific criteria for success, including constraints on materials, time, and cost.
• U3 – Engineers 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.
• U4 – Engineers propose a solution to develop for a design problem after evaluating multiple possible designs.
• U5 – Prototypes can be evaluated and improved upon by a series of fair and controlled tests to identify a product's strengths and limitations.</td><td>ESSENTIAL QUESTIONS:
Students will keep considering …
• Q1 – How are potential and kinetic energy related?
• Q2 – What happens to energy during a collision?</td></tr>
</table>

• ETS1.B Developing Possible Solutions – Research on a problem should be carried out before beginning to design a solution. 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. • Science and Engineering Practices – Asking Questions and Defining Problems – Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships. • Science and Engineering Practices – Developing and Using Models – 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 – 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 – 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 – 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. • Science and Engineering Practices – Constructing Explanations and Designing Solutions – 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 – Obtaining, Evaluating, and Communicating Information – Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Crosscutting Concept – Scale, Proportion, and Quantity – Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of	• U6 – Engineers write down everything they do to document their work, organize their thoughts, and show their steps in an engineering notebook. • U7 – Engineers share their work with and get feedback from others at many points throughout the design process. • U8 – Energy is the ability to do work. • U9 – Engineers design mechanisms to change energy by transferring direction, speed, type of movement, and force. • U10 – Potential energy can be stored in many ways and is released as kinetic energy. • U11 – The faster a given object is moving, the more energy it possesses. • U12 – Contact forces transfer energy during a collision, resulting in a change in the object's motion.	
	Acquisition	
	KNOWLEDGE: Students will… • K1 – Explain what happens at each step of the design process. U1 • K2 – State questions that engineers may ask when gathering information about a situation people want to change. U2 • K3 – Identify the differences between invention and innovation. U2 • K4 – List ways in which energy can be transferred. U8, U9	*SKILLS: Students will…* • S1 – Follow a step by step approach to solving a problem. U1 • S2 – Identify specific constraints such as materials, time, or cost that engineers and designers must take into account given a specific design problem. U2 • S3 – Brainstorm and evaluate existing solutions to a design problem.U2, U3 • S4 – Generate multiple solutions to a design problem while taking into account criteria and constraints. U2, U3

time. Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume. • Crosscutting Concept – Systems and System Models – A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • Crosscutting Concept – Systems and System Models – A system can be described in terms of its components and their interactions. • Crosscutting Concept – Energy and Matter – Energy can be transferred in various ways and between objects. • Crosscutting Concept – Structure and Function – Different materials have substructures, which can sometimes be observed. • Crosscutting Concept – Structure and Function – Substructures have shapes and parts that serve functions. • Crosscutting Concept - Patterns – Patterns of change can be used to make predictions. • Crosscutting Concept - Cause and Effect – Cause and effect relationships are routinely identified, tested, and used to explain change. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - People's needs and wants change over time, as do their demands for new and improved technologies. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. *Common Core ELA* • 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. • 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. • RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. • W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. • W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.		• S5 – Use a decision matrix to compare multiple possible solutions to a design problem and select one to develop, taking into account how well each solution meets the criteria and constraints of the problem. U3, U4 • S6 – Plan fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S7 – Perform fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S8 – Organize and maintain an engineering notebook to document work. U6 • S9 – Share findings and conclusions with an audience. U7 • S10 – Classify energy in a system as potential or kinetic energy. U8, U10 • S11 – Explain, citing evidence, the relationship between the speed of an object and the energy of that object. U9, U11 • S12 – Predict the transfer of energy as a result of a collision between two objects. U11, U12 • S13 – Solve a simple design problem involving the transfer of energy and collisions between two objects. U10, U11, U12

• 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. • W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. *Common Core Math* • 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. • MP.4 Model with mathematics. • MP.5 Use appropriate tools strategically.		

Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1: Energy	• Essential questions • Discussion questions after demonstration • Launch Log Ask section responses • Discussion of characters in story of bumper cars • Discussion of seat belt article related to egg car design problem	• Launch Log Ask • Conclusion questions	Activity 1: Energy • In this activity the students read an article on seatbelt safety and discuss the reading with a classmate.	K2, K4
Activity 2: Potential and Kinetic Energy	• Essential questions • Discussion of the change from potential to kinetic energy after Skateboard Simulation and physical demonstration • Student completion of the teacher chosen app	• Student completion of the teacher chosen app (optional) • Conclusion questions	Activity 2: Potential and Kinetic Energy • In this activity students will observe real world applications of potential and kinetic energy and classify energy in a system as either potential or kinetic.	K1, K2, K3, K4, S10
Activity 3: Speed and Energy	• Essential questions • Answer to the question in procedure part 1 • Data recording in part 2 • Prediction of distance that car will travel at each height in part 2 • Answer to the question in procedure part 2	• Video of pendulum swing and collision car (optional) • Answer to the question in procedure part 1 • Prediction of distance that car will travel at each height in part 2 • Answer to the question in procedure part 2 • Conclusion questions	Activity 3: Speed and Energy • In this activity students explore the relationship between speed and energy of an object by assembling a simple model of a pendulum and vehicle and documenting the changes to the system that can increase or decrease the speed of the objects. Changes to the system will include varying the amount of potential energy by altering the mass or initial height of the objects.	S10, S11
Project: Energy Transfer in Collisions	• Essential questions • Discussion of sound created by a car accident • Slow motion analysis of collision video (optional)	• Discussion of Potential and Kinetic Energy simulation demonstration • Conclusion questions	Project: Energy Transfer in Collisions • In this project students will describe elastic and inelastic collisions in systems they construct using VEX IQ equipment. Students will also describe how energy is conserved and	S11, S12

	• Data recording and sketch of each collision in Launch Log • Discussion of Potential and Kinetic Energy simulation demonstration			transferred in a collision, including changes in motion and the production of heat and sound.	
Problem: Vehicle Restraint Design	• Essential questions • Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Communication of the design solution	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Results of the prototype testing • Communication of the design solution • Conclusion questions	Problem: Vehicle Restraint Design • In this design challenge, students will design a restraint system or alter the vehicle design to protect a passenger in a car during a collision. Students will prototype their design using the VEX IQ vehicle they constructed in Activity 3 and an egg as a passenger. The solution will be tested by rolling the vehicle down an inclined plane at varying slopes to evaluate the effectiveness of the design. Students will use technology to present their design solution, test outcomes, and provide suggestions for improvement.		K1, K2, S1, S2, S3, S4, S5, S6, S7, S8, S9 S11, S12, S13
Energy: Collisions Check for Understanding		Check for Understanding Summative Assessment	Energy: Collisions Check for Understanding		K4, S10, S11, S12

Curriculum Framework
PLTW Launch – 4th Grade – Energy: Conversion

Desired Results *(stage 1)*

Standards

Next Generation Science Standards

- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- PS2.A: Forces and Motion – Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.
- PS2.A: Forces and Motion – The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.
- PS2.B: Types of Interactions – Objects in contact exert forces on each other.
- PS2.B: Types of Interactions – Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
- 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.

Transfer

Students will be able to independently use their learning to …

T1 – Evaluate a problem in a new and novel situation.
T2 – Apply a step by step design process to solve a problem.
T3 – Identify energy conversion in everyday situations.

Meaning

UNDERSTANDINGS:
Students will understand that …

- U1 – Engineers have a step by step approach for looking at and solving a problem called the design process.
- U2 – Engineers and designers create new products and technology to meet a need or want that meets specific criteria for success, including constraints on materials, time, and cost.
- U3 – Engineers 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.
- U4 – Engineers propose a solution to develop for a design problem after evaluating multiple possible designs.
- U5 – Prototypes can be evaluated and improved upon by a series of fair and controlled tests to identify a product's strengths and limitations.
- U6 – Engineers write down everything they do to document their work, organize their

ESSENTIAL QUESTIONS:
Students will keep considering …

- Q1 – How are energy conversion and transfer related?
- Q2 – How can humans use energy conversion and transfer to meet needs and wants?
- Q3 – How is usable energy converted from resources in your area?
- Q4 – What are some energy conversions that take place to create usable energy in a community?

• 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 accounts. • ETS1.B Developing Possible Solutions – Research on a problem should be carried out before beginning to design a solution. 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. • Science and Engineering Practices – Asking Questions and Defining Problems – Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships. • Science and Engineering Practices – Developing and Using Models – 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 – 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 – 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 – 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. • Science and Engineering Practices – Constructing Explanations and Designing Solutions – 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 – Obtaining, Evaluating, and Communicating Information – Builds on K-2 experiences and	thoughts, and show their steps in an engineering notebook. • U7 – Engineers share their work with and get feedback from others at many points throughout the design process. • U8 – Energy is the capacity to do work. • Energy has the ability to cause motion or create change. • U9 – Two types of energy exist: potential (stored energy) and kinetic (energy in motion). • U10 – Six main forms of energy include light, thermal, electrical, mechanical, chemical, and nuclear. • U11 – Energy can be converted from one form to another to meet a human need or want. • U12 – Energy can be transferred from place to place by sound, light, heat, and electric current.	
	Acquisition	
	KNOWLEDGE: Students will… • K1 – Explain what happens at each step of the design process. U1 • K2 – State questions that engineers may ask when gathering information about a situation people want to change. U2 • K3 – Identify the differences between invention and innovation. U2 • K4 – List examples in which energy is converted between potential and kinetic energy. U9, U10 • K5 – Describe six main forms of energy, including light, thermal, electrical, mechanical, chemical, and nuclear. U11 • K6 – List ways in which energy may be converted from one form to another. U12 • K7 – Describe how sound, light, heat, and electric current can transfer energy. U13	*SKILLS: Students will…* • S1 – Follow a step by step approach to solving a problem. U1 • S2 – Identify specific constraints such as materials, time, or cost that engineers and designers must take into account given a specific design problem. U2 • S3 – Brainstorm and evaluate existing solutions to a design problem.U2, U3 • S4 – Generate multiple solutions to a design problem while taking into account criteria and constraints. U2, U3 • S5 – Use a decision matrix to compare multiple possible solutions to a design problem and select one to develop,

progresses to evaluating the merit and accuracy of ideas and methods. • Crosscutting Concept – Patterns – Patterns can be used as evidence to support an explanation. • Crosscutting Concept – Cause and Effect – Case and effect relationships are routinely identified, tested, and used to explain change. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - People's needs and wants change over time, as do their demands for new and improved technologies. • Crosscutting Concept – Influence of Science, Engineering, and Technology on Society and the Natural World - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. *Common Core ELA* • 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. • 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. • RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. • RI.4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4-5 text complexity band proficiently, with scaffolding as needed at the high end of the range. • W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. • W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. • W.4.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. • SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly. • SL.4.3 Identify the reasons and evidence a speaker provides to support particular points. *Common Core Math* • MP.4 Model with mathematics.		taking into account how well each solution meets the criteria and constraints of the problem. U3, U4 • S6 – Plan fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S7 – Perform fair tests in which variables are controlled to identify a product's strengths and limitations. U5 • S8 – Organize and maintain an engineering notebook to document work. U6 • S9 – Share findings and conclusions with an audience. U7 • S10 – Differentiate between potential and kinetic energy. U8, U9 • S11 – Explain how energy can be converted to meet a human need or want. U9, U10 • S12 – Compare and contrast the transfer and conversion of energy. U10, U11, U12, U13 • S13 – Apply scientific ideas about the conversion of energy to solve a simple design problem. U10, U11, U12 • S14 – Design a system that is able to store energy and then convert the energy to a usable form as it is released. U10, U11, U12, U13

• MP.5 Use appropriate tools strategically.		

Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1: What is Energy Conversion?	• Essential questions • Discussion of three fictional characters and the food pantry unloading problem • Student documentation and presentation of potential and kinetic energy classroom examples • Responses to Part 2 Observing a KinetiCan • Responses to Part 4 Converting Chemical to Mechanical Energy	• Popplet presentation of potential and kinetic energy classroom examples • Student documentation and presentation of potential and kinetic energy classroom examples • Responses to Part 2 Observing a KinetiCan • Responses to Part 4 Converting Chemical to Mechanical Energy • Conclusion questions	Activity 1: What is Energy Conversion? • In this activity students review potential and kinetic energy and create a model to demonstrate the conversion between kinetic energy to potential energy and back. Finally, students reflect on human energy sources and how energy from food is converted to usable energy.	K1, K2, K3, K4
Activity 2: Energy Conversion in Action	• Essential questions • Observation documentation of each station in Launch Log • Recording image of each station in Launch Log • Responses to the three prompts presented in Step Part 1 #3. • Labels of part 1 documentation completed in step Part 2 #5	• Observation documentation of each station in Launch Log • Responses to the three prompts presented in Step Part 1 #3. • Labels of part 1 documentation completed in step Part 2 #5 • Digital presentation of one observed energy conversion • Conclusion questions	Activity 2: Energy Conversion in Action • In this activity students experience several types of energy conversion. As they work through the activity, they will be exposed to vocabulary that can be used in the final part of the activity in which the students create a digital presentation detailing one example of energy conversion.	K5, K6, S9, S10, S11
Activity 3: Light Up Your World	• Essential questions • Educreations app document prediction of how energy is converted between forms using a coin battery and LED	• Educreations app document prediction of how energy is converted between forms using a coin battery and LED • Popplet presentation of one energy source • Conclusion questions	Activity 3: Light Up Your World • This activity is designed to provide context for students learning about the sources of energy, its conversion into electrical energy, transporting energy to our homes and industry, and ultimately its conversion into forms of energy that benefit us, including light, thermal, and mechanical energy.	K6, K7, S11, S12

	• Documented plan with updates to dismantle the flashlight • Documentation of Research on one energy source • Popplet presentation of one energy source			
Project: Harnessing Energy	• Essential questions • Documentation in the Launch Log of each of the design process steps • Popplet presentation of the design solution	• Popplet presentation of the design solution • Conclusion questions	Project: Harnessing Energy • In this project students will use two devices built with VEX IQ® equipment to work toward a solution to a fictional problem involving lifting objects into a tree house.	K1, K2, K3, K4, S10, S11, S13
Problem: Food Pantry Design Problem	• Essential questions • Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Communication of the design solution	• Documentation in the Launch Log of each of the design process steps • Physical construction of the prototype • Results of the prototype testing • Communication of the design solution • Conclusion questions	Problem: Food Pantry Design Problem • In this problem students will design and model a system to unload boxes of food at a community food pantry.	K1-7, S1-14
Energy: Conversion Check for Understanding		Check for Understanding Summative Assessment	Energy: Conversion Check for Understanding	K4, K5, K6, K7, S10, S11, S12

Curriculum Framework
PLTW Launch – 4th Grade – Input/Output: Computer Systems

Desired Results *(stage 1)*

Standards

Computer Science Teachers Association K-12 CS Standards

- 1B-CS-01 Describe how internal and external parts of computing devices function to form a system.
- 1B-CS-02 Model how computer hardware and software work together as a system to accomplish tasks.
- 1B-NI-04 Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination.
- 1B-NI-05 Discuss real-world cybersecurity problems and how personal information can be protected.
- 1B-DA-06 Organize and present collected data visually to highlight relationships and support a claim.
- 1B-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
- 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended.
- 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development.
- 1B-IC-19 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users.

Next Generation Science Standards

Transfer

Students will be able to independently use their learning to…

T1 – Apply general understanding of computer systems to make sense of human-made machines.
T2 – Apply technology to solve age-appropriate challenges by creating digital artifacts such as games or tools.
T3 – Develop efficient solutions to computational problems by breaking into subproblems and identifying parts that can be abstracted and modularized.

Meaning

UNDERSTANDINGS: Students will understand that…

- U1 – Computers are systems of inputs, outputs, and processors that can perform many tasks very quickly.
- U2 – Computing is a collaborative activity that fosters creativity, communication, and teamwork.
- U3 – People use technology to create useful tools that make our lives easier.
- U4 – Data can be collected and organized to represent meaningful information using digital tools.
- U5 – The Internet is a resource for research and collaboration that must be used in a safe and responsible way.
- U6 – The display on a digital screen corresponds to an x-y coordinate system.
- U7 – Modularization, breaking problems into subproblems, and abstraction, ignoring details while focusing on common properties, are important steps to take when developing solutions with technology.
- U8 – Computer programs do not need to be right the first time. Testing and fixing things is normal when programming.

ESSENTIAL QUESTIONS: Students will keep considering…

- Q1 – How does a computer system work?
- Q2 – How do humans translate a problem so that a computer can operate on it?
- Q3 – What are the advantages that technology offers to humans that allow us to accomplish things we couldn't do without technology?

Acquisition

- 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.
- 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 accounts.
- ETS1.B Developing Possible Solutions—Research on a problem should be carried out before beginning to design a solution. 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.

Common Core ELA

- CCSS.ELA-LITERACY.L.3.1
  Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- CCSS.ELA-Literacy.3.RI.3
  Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- CCSS.ELA-Literacy.3.SL.1
  Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).

Common Core Math

- CCSS.Math.Practice.MP1
  Make sense of problems and persevere in solving them.
- CCSS.Math.Practice.MP2
  Reason abstractly and quantitatively.
- CCSS.Math.Practice.MP4
  Model with Mathematics.

KNOWLEDGE: Students will…

- K1 – Explain why computer scientists break big problem into subproblems. U7
- K2 – Identify parts of a computational solution that can be abstracted and modularized in order to make the solution efficient and generalizable. U7
- K3 – Identify basic input and output devices in computer systems. U1
- K4 – Give examples of real-life applications of computer systems. U2, U3, U4, U5
- K5 – Give examples of how collaboration can lead to better solution design. U2, U3, U8
- K6 – Recognize that a data set can be represented in various ways to convey different information. U4
- K7 – Explain safe and responsible use of the Internet. U5
- K8 – Identify events that drive a program's behavior such as external user interaction and internal variable counters. U1, U3, U4, U6

SKILLS: Students will…

- S1 – Organize and collaborate with group members by assigning roles and taking turns. U2
- S2 – Use technology to express ideas. U1, U2, U3, U4, U5, U6, U7, U8
- S3 – Decompose a problem and use a predefined set of commands to write an algorithm that will solve the problem. U1, U7
- S4 – Demonstrate the correct use of the x-y coordinate system when manipulating object positions and movement on a screen during an animated solution. U6, U7
- S5 – Use functions to modularize repetitive tasks, break a program down into smaller pieces, and to make the program more efficient. U7
- S6 – Use variables appropriately as part of a computational solution to store and manipulate values that may change as the program runs. U7
- S7 – Implement a loop when appropriate to make a program repeat a section of code until an ending condition is reached. U7
- S8 – Use a conditional statement in a program as a true/false test to make the program follow a specified sequence of steps depending on the state of the condition. U7
- S9 – Program characters in an animation or game to respond to event triggers. U1, U2, U3, U6, U7, U8
- S10 – Demonstrate persistence in the cycle of testing, finding, and fixing problems in computer programs. U2, U7, U8
- S11 – Identify similarities between a computer system and a human body (input, processing, output). U1
- S12 – Explain how text and image data can be represented by strings of 1s and 0s. U1, U4

• CCSS.Math.Practice.MP5 Use appropriate tools strategically.		

Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1 Input, Processing, and Output	Teacher will observe students as they participate in the role-playing activity. Teacher will answer questions during the activity.	Launch Logs will display students' understanding of the parallels between human body systems and computer systems. Students will demonstrate knowledge of inputs, processors, supporting structures, and outputs in both systems. Conclusion questions can be discussed to help assess student understanding.	4_3_1A Input, Processing, and Output • In this activity students learn about the anatomy of a computer system and its similarities to a human body, including input, processing, and output. Students learn the roles of basic computer hardware components and how they compare to the functions of human organs. • Students watch a video presentation that corresponds to the Biomedical Science Launch module 4_4. Students map the similar functions of parts of the human body to those of the computer: eyes/ears, sense/nerves (input), brain (processor), nerves/muscles (output), mouth (output). • Input, Output, Reaction Time. Students play a game where they measure reaction time as a group by passing a signal around a circle—first from hand to shoulder and then from hand to ankle. This will allow them to see the difference in reaction time when the pathway from shoulder to brain to hand is shorter than the pathway from ankle to brain to hand.	K3, S1, S11
Activity 2 Information Highway	Teacher will discuss content with students and answer their questions. Teacher will check student worksheets. Teacher will observe students' participation in group activity.	Launch Logs will show students' knowledge of data translation into bits and will demonstrate that they can transfer this to similar situations. Conclusion questions can be discussed to help assess student understanding.	4_3_2A Information Highway • In this activity students are introduced to the concept of abstraction and data representation in a computer system. Students learn that all electronic information must be translated to bits of data to be understood by the computer. • Basic information about the Internet is addressed, including privacy, safety, and appropriate behavior.	K1, K4, K7, S12
Activity 3 Data Collection and Display	Teacher will discuss with students, answer questions, and observe students' participation in group programming.	Teacher will evaluate the end product (Collect-Count-Display program) from each team of students. Launch Log entries will demonstrate students' understanding of the system they built.	4_3_3A Data Collection and Display • In this activity students begin by looking at data sets and considering how the data can be represented in different ways. • Students are introduced to programming using Tynker. Students learn basic programming concepts, including sequencing, repetitions, conditionals, events, functions, and using variables. • Students program an interactive game that collects data and then displays the collected data in a visual representation.	K1, K6, K8, S4, S5, S6, S7, S8, S10

		Conclusion questions can be discussed to help assess student understanding.	• Students learn to break a problem down into subproblems and understand what data needs to be stored so it can be operated on later.	
Project 4 Reaction Test	Teacher will discuss with students, answer questions, and observe students' participation in group programming.	Teacher will evaluate the end product (Reaction Test program) from each team of students. Launch Log entries will demonstrate students' understanding of the system they built. Conclusion questions can be discussed to help assess student understanding.	4_3_4P Reaction Test • In this project students will create an interactive app to test the user's alertness, which can help diagnose a concussion. The app specifications are explicitly defined to the students. • Students will use knowledge and skills learned in the previous activities to process events, use variables, functions, repetitions, and conditionals. • Students will walk through the five steps of the design process as they work through their project. • Students will work in groups and collaborate as they brainstorm ideas and plan their designs in their Launch Logs. • The app that the students create in this project can be used to relate to the Biomedical Science Launch module 4_4.	K2, K4, K5, S1, S2, S3, S9, S10
Problem 5 Brain Fitness	Teacher will discuss with students, answer questions, and observe students' participation in group programming.	Student groups will present their end product (Brain Fitness program). Launch Log entries will demonstrate students' understanding of the system they built. Conclusion questions can be discussed to help assess student understanding.	4_3_5B Brain Fitness • In this problem students will create an interactive app to assess the user's brain function, which can serve as a baseline for concussion testing. There are suggested ideas for the app. However, students choose whether they will use any of the suggestions or create their own idea for the game. • Students will use knowledge and skills learned in the previous activities to process events, use variables, functions, repetitions, and conditionals. • Students will walk through the five steps of the design process as they work through their problem. • Students will work in groups and collaborate as they brainstorm ideas and plan their designs in their Launch Logs. • The app that the students create in this project can be used to relate to the Biomedical Science Launch module 4_4.	K1 , K2, K3, K4, K5, K8, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11
I/O: Computer Systems Check for Understanding	Teacher reviews the CFU with the students after they have answered the questions.	Check for Understanding Summative Assessment: –Data representation –Computer input, processing, output	I/O: Computer Systems Check for Understanding	K3, K6, K8, S5, S6, S7, S8, S9, S12

		–Modularization: functions, variables –Control Flow: repetitions, conditionals, events		

Curriculum Framework
PLTW Launch – 4th Grade – Input/Output: Human Brain

Desired Results *(stage 1)*

Standards

Next Generation Science Standards

- ETS1-1 Define a simple problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 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.
- 4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- 4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- LS1.A Structure and Function – Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- LS1.D Information Processing – Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions.
- 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 accounts.
- ETS1.B Developing Possible Solutions – Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions

Transfer

Students will be able to independently use their learning to …

T1 – Identify how damage to any part of the nervous system might impact function.
T2 – Apply a step by step process to design and perform investigations to find answers to questions.
T3 – Utilize critical thinking skills to solve a problem.

Meaning

UNDERSTANDINGS: Students will understand that …

- U1 – Scientists ask and identify questions to gain knowledge or solve problems.
- U2 – Scientists develop and use models to represent amounts, relationships, relative scales, and/or patterns in the natural and designed world(s).
- U3 – Scientists plan and conduct investigations collaboratively to produce data that serves as evidence used to answer questions.
- U4 – Scientists make predictions based on prior experiences.
- U5 – Scientists make observations and/or collect data to construct evidence-based conclusions for natural phenomena.
- U6 – Scientists keep and organize all of their work in a scientific notebook.
- U7 – Scientists work collaboratively and communicate their findings with others.

ESSENTIAL QUESTIONS: Students will keep considering …

- Q1 – How does your body sense input from the outside world and make an appropriate response?
- Q2 – How can medical professionals use patient symptoms to diagnose brain injuries?
- Q3 – How does information we see in the media influence our decisions about healthy behavior?

is an important part of the design process, and shared ideas can lead to improved designs. • Science and Engineering Practices – Asking Questions and Defining Problems – Asking questions and Builds on K-2 experiences and progresses to specifying qualitative relationships. • Science and Engineering Practices – Developing and Using Models – 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 – 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 – 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 – 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. • Science and Engineering Practices – Constructing Explanations and Designing Solutions – 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 – Obtaining, Evaluating, and Communicating Information – Builds on K-2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Crosscutting Concept – Cause and Effect – Case and effect relationships are routinely identified, tested, and used to explain change. • Crosscutting Concept – Scale, Proportion, and Quantity – Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long periods of time. Standards units are used to measure and describe physical quantities such as weight, time, temperature, and volume.	• U8 – The design process is a step by step method used to guide people in developing solutions to problems. • U9 – The nervous system is composed of many unique structures, each with a specific function. • U10 – The nervous system receives stimuli from the outside world, interprets this information, and generates an appropriate response. • U11 – Brain processing determines how we store memories and how quickly and appropriately the body responds to internal and external stimuli. • U12 – Damage to the nervous system can lead to disease or dysfunction.	
	Acquisition	
	KNOWLEDGE: Students will… • K1 – Describe how each region within the brain helps control and regulate specific functions in the body. U9, U10, U11, U12 • K2 – Describe how different sense receptors are specialized for particular kinds of information. U9, U10 • K3 – Describe how the organs responsible for each sense communicate with the brain. U9, U10 • K4 – Recognize that the nervous system relies on specialized cells called neurons to pass signals to and from the brain and spinal cord. U9, U10 • K5 – Recognize that many brain injuries can be prevented. U12	*SKILLS: Students will…* • S1 – Identify major regions of the human brain.U9, U10, U12 • S2 – Outline what happens in the human body from an initial stimulus to a response. U2, U9, U10, U12 • S3 – Perform an investigation in order to draw conclusions. U1, U2, U3, U4, U5, U6, U7 • S4 – Maintain a notebook to document work. U1, U3, U4, U5, U6, U7, U8 • S5 – Share findings and conclusions with others. U6, U7 • S6 – Follow a step by step method to solve a problem. U1, U2, U3, U6, U7, U8, U12

• Crosscutting Concept – Systems and System Models – A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. • Crosscutting Concept – Systems and System Models – A system can be described in terms of its components and their interactions. • Crosscutting Concept – Energy and Matter – Energy can be transferred in various ways and between objects. • Crosscutting Concept – Structure and Function – Different materials have substructures, which can sometimes be observed. • Crosscutting Concept – Structure and Function – Substructures have shapes and parts that serve functions. *Common Core ELA* • RL.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. • RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text. • RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area. • RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. • W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. • W.4.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences. • W.4.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic. • W.4.2.E Provide a concluding statement or section related to the information or explanation presented. • W.4.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. • W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. • 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.		

• SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. • SL.4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. *Common Core Math* • CCSS.MATH.CONTENT.4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. • 4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. • MP.2 Reason abstractly and quantitatively. • MP.4 Model with mathematics. • MP.5 Use appropriate tools strategically. • 3-5.OA Operations and Algebraic Thinking		

Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems (B)	Knowledge and Skills
Activity 1: The Body's Computer	• Essential questions • Documentation of key ideas on Nervous System Resource Sheet • Building of central nervous system on body outlines	• Completed questions on Nervous System Resource Sheet • Final model of central nervous system with tape flags identifying key functions of each area • Conclusion questions	Activity 1: The Body's Computer • In this activity students will be introduced to the structure and function of the nervous system and learn about the brain and spinal cord, which together make up the central nervous system. • Students will build a model brain out of clay and identify what each region of the brain does.	K1, K4, S1
Activity 2: Senses Exploration	• Essential questions • Completion of senses station explorations with documentation of observations • Discussion of observations for each sense station	• Completed labeling of sense structures diagrams • Identification of structure that helps send signals about each sense to the brain • Identification of area of the brain associated with each sense • Conclusion questions	Activity 2: Senses Exploration • In this activity students will explore how the brain takes in information from the outside world. They will investigate each of the five senses and complete an activity to test each sense and learn how the organs responsible for each sense communicate with the brain.	K1, K2, K3
Activity 3: The Brain in Action	• Essential questions • Completion of memory stations and reaction time tests • Discussion and completion of each step of the scientific inquiry process	• Completion and explanation of inquiry experiment • Documentation of each step of the scientific inquiry process in the Launch Log • Conclusion questions	Activity 3: The Brain in Action • In this activity the teacher will investigate how the brain processes the information it takes in through the senses and how it stores the information as memories. • Students will complete a scientific inquiry investigation to explore reaction time.	S3, S4, S5
Project: Information Processing	• Essential questions • Completion of the Input and Output in the Human Body Presentation • Documentation of key ideas on the Peripheral	• Identification of input and output in three scenarios • Completed questions on Peripheral Nervous System Resource Sheet • Illustration of the path of information to and from	Project: Information Processing • In this project students will use everything they have learned thus far in the module and put it all together to explore how our bodies sense information from the outside world, process this information, and cause an appropriate response or reaction in the body.	K1, K2, K3, K4, S2

	Nervous System Resource Sheet • Completion of kinesthetic activity to model signal transmission through neurons	the central nervous system on the body outline for three scenarios, using one color to represent input and another color to represent output (and appropriate text boxes) • Conclusion questions	• Students will outline what happens in the body when they take in information from the world around them and showcase this flow of information on their Body Outline models.	
Problem: Brain Injury Prevention	• Essential questions • Creation of script or storyboard for podcast or video	• Documentation in the Launch Log of each of the design process steps • Discussion of each of the design process steps • Creation of podcast or video • Creation of peer evaluation test • Description of peer evaluation test and reflection on results • Conclusion questions	Problem: Brain Injury Prevention • In this design challenge, students will work as part of a team to design, plan, and create a video or podcast to raise awareness about concussions and educate their peers as to how concussions can either be identified early or prevented completely. • Students will follow a design process, a step by step way to solve problems, to help them develop their video or podcast.	K1, K5, S4, S5, S6
Input/Output: Human Brain Check for Understanding		• Check for Understanding Summative Assessment	Input/Output: Human Brain Check for Understanding	K1, K4, S1, S2

Modifications

Special Education/504:	English Language Learners:
• Adhere to all modifications and health concerns stated in each IEP. • Give students a MENU of options, allowing them to choose assignments from different levels based on difficulty. • Accommodate Instructional Strategies: use of post-its, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time • Allow extra time to complete assignments or tests • Allow students to demonstrate understanding of a problem by drawing a functional model of the answer and then explaining the reasoning orally and/or writing. • Provide breaks between tasks, use positive reinforcement, use proximity • Work in a small group • Use large print books, Braille, or digital texts • Strategies for Students with 504 Plans	• Simplify written and verbal instructions • Use manipulatives to promote conceptual understanding and enhance vocabulary usage • Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing • Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words • Provide graphic representations, gestures, drawings, equations, and pictures during all segments of instruction • Utilize program translations tools such as Snap and Read (if available) • Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information • Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve real life problems. • Reword questions in simpler language • Provide class notes ahead of time to allow students to preview material and increase comprehension • Provide extended time
Gifted and Talented:	**Students at Risk for Failure:**
• Organize and offer flexible small group learning opportunities / activities. • Utilize elevated contextual complexity • Inquiry based or open ended assignments, performance tasks and projects • Allow more time to study concepts with greater depth • Provide options, alternatives and choices to differentiate and broaden the curriculum. • Promote the synthesis of concepts and making real world connections • Provide students with enrichment practice that are imbedded in the	• Assure students have experiences that are on the Concrete- Pictorial-Abstract spectrum • Modify Instructional Strategies; extended time, reading aloud text, graphic organizers, flexible grouping, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Utilize Scaffolded Questioning, Field Trips, Google Expeditions, Peer Support, Modified Assignments, Chunking of Information, Peer Buddies • Assure constant parental/ guardian contact throughout the year with successes/ challenges

curriculum o allowing students to design problems to be addressed by the class o allowing students to modify the lesson by introducing a related phenomena o allow for interest-based extension activities • Utilize an enhanced set of introductory activities (e.g. phenomena, organizers, concept maps etc) • Provide whole group enrichment explorations. • Teach cognitive and methodological skills • Allow for the use of stations • Organize integrated problem-solving simulations.	• Provide academic contracts to students and guardians • Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. • Always plan to address students at risk in the designing of learning tasks, instructions, and directions. • Try to anticipate where the needs will be and then address them prior to lessons. • Teacher should allow for preferential seating • Include Visual Cues/Modeling • Allow for technology Integration, especially Assistive Technology

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. These skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the 21st century workplace.

As such, they should be taught and reinforced in all career exploration and preparation programs, with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are provided with an equitable opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are also encouraged to reason through experiences and exposure to phenomena that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.
B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.
F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.
B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.
C. **Design:** The design process is a systematic approach to solving problems.
D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.
E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:

Science:

- 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- LS1.A Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- LS1.D Information Processing: Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions.
- PS2.A Forces and Motion: Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.
- PS2.B Types of Interactions: Objects in contact exert forces on each other.
- PS2.B Types of Interactions: Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
- 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.
- 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 accounts.

- ETS1.B Developing Possible Solutions: Research on a problem should be carried out before beginning to design a solution. 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.
- ETS1.C Optimizing the Design Solution: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Interdisciplinary Connections:

English Language Arts:

- 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.
- RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- 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.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
- RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
- RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- W.4.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.
- W.4.2.E Provide a concluding statement or section related to the information or explanation presented.
- W.4.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
- W.4.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- 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.
- RI.4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4-5 text complexity band proficiently, with scaffolding as needed at the high end of the range.
- W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- 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.
- W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
- SL.4.1.B Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
- SL.4.1.B Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
- SL.4.3 Identify the reasons and evidence a speaker provides to support particular points.
- SL.4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Interdisciplinary Connections:

Mathematics:

- 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.
- 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
- 4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.
- MP.1 Make sense of problems and persevere in solving them.
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.
- MP.5 Use appropriate tools strategically.