

Curriculum Education Standards



F1 Key Concepts

Unit Overview:
In this unit you will explore key STEM concepts that many engineers use in their everyday work. These concepts are also very useful when it comes to the design of mechanical systems.

Unit Content:

- Friction
- Center of Gravity
- Speed, Torque, and Power
- Mechanical Advantage

Unit Activities:

- Matching Exercise
- Idea Book Exercise



Note: Separate copies and/or printouts of activities may be used for student work. Please see your teacher for more information. Visit www.vexiq.com/curriculum to download and print PDFs of all exercises and activities.

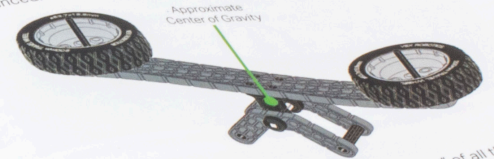
F2 Friction

Friction is the force that resists motion through the rubbing of one object against another. It is a reaction force only. It occurs when two surfaces are in contact and a force is applied to a mass, causing the surfaces to slide against one another. If an object has no forces trying to cause motion, there is no friction. No applied force means no reaction force.

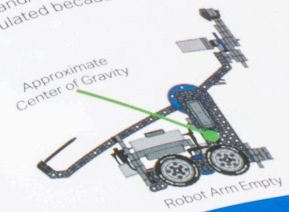


F3 Center of Gravity

Center of Gravity is the place in a system or body (such as a robot) where the weight is evenly distributed and all sides are in balance. An example of center of gravity is the middle of a seesaw when it is balanced.



You can think of a robot's center of gravity as the "center position" of all the weight. Because Center of Gravity uses both weight and position, heavier objects have a lower center of gravity than lighter ones. In determining where the center of gravity is, for example, when collecting, holding, and/or manipulating objects, those objects change the center of gravity being manipulated because they add weight.



Approximate Center of Gravity

Unit A: It's Your Future

Unit Standards Connections: Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
K-2	Engineering Design	K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	- Optional Idea Book Exercise

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.B	K-2	Students will develop an understanding of the characteristics and scope of technology.	All people use tools and techniques to help them do things.	- Matching Exercise
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	- Matching Exercise - Optional Research Activity - Optional Idea Book Exercise
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	- Optional Research Activity - Optional Idea Book Exercise
3.A	K-2	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	The study of technology uses many of the same ideas and skills as other subjects.	- Matching Exercise
3.C	3-5	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Various relationships exist between technology and other fields of study.	- Matching Exercise - Optional Research Activity - Optional Idea Book Exercise
3.F	6-8	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.	- Matching Exercise - Optional Research Activity - Optional Idea Book Exercise
6.A	K-2	Students will develop an understanding of the role of society in the development and use of technology.	Products are made to meet individual needs and wants.	- Optional Research Activity
6.B	3-5	Students will develop an understanding of the role of society in the development and use of technology.	Because people's needs and wants change, new technologies are developed, and old ones are improved to meet those changes.	- Optional Research Activity
6.D	6-8	Students will develop an understanding of the role of society in the development and use of technology.	Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.	- Optional Research Activity
9.A	K-2	Students will develop an understanding of engineering design.	The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.	- Optional Idea Book Exercise

Unit B: Let's Get Started

Unit Standards Connections:

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.B	K-2	Students will develop an understanding of the characteristics and scope of technology.	All people use tools and techniques to help them do things.	<ul style="list-style-type: none"> - Using The Hardware Handout - Using the VEX IQ Controller and Robot Brain Handout - Matching Exercise
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Using The Hardware Handout - Using the VEX IQ Controller and Robot Brain Handout - Matching Exercise
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Using The Hardware Handout - Using the VEX IQ Controller and Robot Brain Handout - Matching Exercise

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.MD	4	Measurement & Data	Geometric measurement: understand concepts of angle and measure angles.	<ul style="list-style-type: none"> - Optional mathematics activity

Unit C: Your First Robot

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
3-5	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.	- Clawbot IQ Build - Idea Book Pages
3-5	Engineering Design	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.	- Clawbot IQ Build - Idea Book Pages

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	- Clawbot IQ Build - Idea Book Pages
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	- Clawbot IQ Build - Idea Book Pages
2.G	3-5	Students will develop an understanding of the core concepts of technology.	When parts of a system are missing, it may not work as planned.	- Clawbot IQ Build - Idea Book Pages
2.L	3-5	Students will develop an understanding of the core concepts of technology.	Requirements are the limits to designing or making a product or system.	- Clawbot IQ Build: Following Assembly Instructions
2.Q	6-8	Students will develop an understanding of the core concepts of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	- Clawbot IQ Build - Idea Book Pages
2.R	6-8	Students will develop an understanding of the core concepts of technology.	Requirements are the parameters placed on the development of a product or system.	- Clawbot IQ Build: Following Assembly Instructions - Build Rubric
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	- Review of Content Materials - Idea Book Pages
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	- Clawbot IQ Build: Following Assembly Instructions
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	- Clawbot IQ Build - Idea Book Pages

Unit C cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	<ul style="list-style-type: none"> - Review of Content Materials - Clawbot IQ Build - Idea Book Pages
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	<ul style="list-style-type: none"> - Clawbot IQ Build - Build Rubric - Idea Book Pages
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Review of Content Materials
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Clawbot IQ Build - Idea Book Pages
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Clawbot IQ Build - Idea Book Pages
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Clawbot IQ Build: Following Assembly Instructions - Build Rubric - Idea Book Pages

Unit D: Simple Machines & Motion

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
K-2	Engineering Design	K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	<ul style="list-style-type: none"> - Sample Assembly Build(s) - Machine Design Activities - Robot Design Activities - Idea Book Exercises
3	Motion and Stability: Forces & Interactions	3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	<ul style="list-style-type: none"> - Pendulum definition and Sample Assembly Build
5	Motion and Stability: Forces & Interactions	5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.	<ul style="list-style-type: none"> - Pendulum and gravity definition and Sample Assembly Pendulum Build
3-5	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.	<ul style="list-style-type: none"> - Sample Assembly Build(s) - Machine Design Activities - Robot Design Activities - Idea Book Exercises
3-5	Engineering Design	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.	<ul style="list-style-type: none"> - Sample Assembly Build(s) - Machine Design Activities - Robot Design Activities - Idea Book Exercises
6-8	Energy	MS-PS3-5	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.	<ul style="list-style-type: none"> - Use of pertinent definitions from content materials along with: - Robot Design Activities - Idea Book Exercises
6-8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises
6-8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises

Unit D cont.

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Unit Content Materials Review - Sample Assembly Build(s) - Machine Design Activities - Robot Design Activities
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises
2.C	K-2	Students will develop an understanding of the core concepts of technology.	Tools are simple objects that help humans complete tasks.	<ul style="list-style-type: none"> - Unit Content Materials Review - Sample Assembly Build(s)
2.K	3-5	Students will develop an understanding of the core concepts of technology.	Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.	<ul style="list-style-type: none"> - Sample Assembly Build(s) - Machine Design Activities - Robot Design Activities - Idea Book Exercises
2.L	3-5	Students will develop an understanding of the core concepts of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Following directions for Sample Assembly build(s) and Design Activities
3.F	6-8	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.	<ul style="list-style-type: none"> - Applying scientific definitions from unit Content Materials to: - Machine Design Activities - Robot Design Activities - Idea Book Exercises
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Idea Book Exercises in conjunction with Design Activities
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	<ul style="list-style-type: none"> - Following directions for Sample Assembly build(s) and Design Activities
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Machine Design Activities - Robot Design Activities - Idea Book Exercises

Unit E: Chain Reaction Challenge

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
4	Energy	4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	- Device Build(s) - Idea Book Pages
4	Energy	4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	- Device Build(s) - Idea Book Pages
3-5	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.	- Device Build(s) - Idea Book Pages - Following Challenge Rules
3-5	Engineering Design	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.	- Device Build(s) - Idea Book Pages - Following Challenge Rules
3-5	Engineering Design	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.	- Device Build(s) - Idea Book Pages - Following Challenge Rules
6-8	Energy	MS-PS3-5	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.	- Device Build(s) - Idea Book Pages
6-8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	- Device Build(s) - Idea Book Pages
6-8	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	- Device Build(s) - Idea Book Pages
6-8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	- Device Build(s) - Idea Book Pages

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	- Device Build(s) - Idea Book Pages
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	- Device Build(s) - Idea Book Pages

Unit E cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
2.G	3-5	Students will develop an understanding of the core concepts of technology.	When parts of a system are missing, it may not work as planned.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
2.L	3-5	Students will develop an understanding of the core concepts of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
2.Q	6-8	Students will develop an understanding of the core concepts of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
2.R	6-8	Students will develop an understanding of the core concepts of technology.	Requirements are the parameters placed on the development of a product or system.	<ul style="list-style-type: none"> - Following Challenge Rules
2.U	6-8	Students will develop an understanding of the core concepts of technology.	Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	<ul style="list-style-type: none"> - Following Challenge Rules
8.F	6-8	Students will develop an understanding of the attributes of design.	There is no perfect design.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages - Following Challenge Rules
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	<ul style="list-style-type: none"> - Following Challenge Rules
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages - Following Challenge Rules

Unit E cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages

Unit E cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
10.H	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Some technological problems are best solved through experimentation.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
11.F	3-5	Students will develop abilities to apply the design process.	Test and evaluate the solutions for the design problem.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
11.G	3-5	Students will develop abilities to apply the design process.	Improve the design solutions.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	<ul style="list-style-type: none"> - Idea Book Pages
4.MD	4	Measurement and Data	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	<ul style="list-style-type: none"> - Idea Book Pages
4.MD	4	Measurement and Data	Represent and interpret data.	<ul style="list-style-type: none"> - Idea Book Pages
6.EE	6	Expressions and Equations	Represent and analyze quantitative relationships between dependent and independent variables.	<ul style="list-style-type: none"> - Idea Book Pages
7.RP	7	Ratios and Proportional Relationships	Analyze proportional relationships and use them to solve real-world and mathematical problems.	<ul style="list-style-type: none"> - Idea Book Pages

Unit F: Key Concepts

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
3	Motion and Stability: Forces and Interactions	3-PS2-1	Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	- Center of Gravity demonstrations
3	Motion and Stability: Forces and Interactions	3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	- Unit Content Materials - Center of Gravity demonstrations
4	Energy	4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	- Unit Content Materials - Idea Book Exercise
5	Motion and Stability: Forces and Interactions	5-PS2	Support an argument that the gravitational force exerted by Earth on objects is directed down.	- Unit Content Materials - Center of Gravity demonstrations
3-5	Engineering Design	3-5-ETS-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.	- Idea Book Exercise

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.H	6-8	Students will develop an understanding of the characteristics and scope of technology.	Technology is closely linked to creativity, which has resulted in innovation.	- Idea Book Exercise
3.C	3-5	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Various relationships exist between technology and other fields of study.	- Unit Content Materials - Matching Exercise - Clawbot IQ Center of Gravity demo - Idea Book Exercise
3.F	6-8	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.	- Unit Content Materials - Matching Exercise - Center of Gravity demonstrations - Idea Book Exercise
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	- Idea Book Exercise
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	- Idea Book Exercise

Unit F cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	- Idea Book Exercise
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	- Idea Book Exercise
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	- Idea Book Exercise
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention and innovation are creative ways to turn ideas into real things.	- Idea Book Exercise
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	- Idea Book Exercise
11.D	3-5	Students will develop abilities to apply the design process.	Identify and collect information about everyday problems that can be solved by technology, and generate ideas and requirements for solving a problem.	- Idea Book Exercise
11.J	6-8	Students will develop abilities to apply the design process.	Make two-dimensional and three-dimensional representations of the designed solution.	- Idea Book Exercise
16.D	3-5	Students will develop an understanding of and be able to select and use energy and power technologies.	Tools, machines, products, and systems use energy in order to do work.	- Unit Content Materials - Matching Exercise
16.E	6-8	Students will develop an understanding of and be able to select and use energy and power technologies.	Energy is the capacity to do work.	- Unit Content Materials - Matching Exercise
16.G	6-8	Students will develop an understanding of and be able to select and use energy and power technologies.	Power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.	- Unit Content Materials - Matching Exercise

Unit G: Mechanisms

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
3	Motion and Stability: Forces and Interactions	3-PS2-2	Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	<ul style="list-style-type: none"> - Object Manipulation - Lifting Mechanisms
3-5	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	<ul style="list-style-type: none"> - Gear Ratio Simulator and Gear Ratio Exercises

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
2.F	3-5	Students will develop an understanding of the core concepts of technology.	A subsystem is a system that operates as a part of another system.	<ul style="list-style-type: none"> - Drivetrains - Object Manipulators - Lifting Mechanisms
2.K	3-5	Students will develop an understanding of the core concepts of technology.	Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.	<ul style="list-style-type: none"> - Drivetrains - Object Manipulators - Lifting Mechanisms
2.S	6-8	Students will develop an understanding of the core concepts of technology.	Trade-off is a decision process recognizing the need for careful compromises among competing factors.	<ul style="list-style-type: none"> - Gear Ratio and relationship between Speed and Torque
3.C	3-5	Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	Various relationships exist between technology and other fields of study.	<ul style="list-style-type: none"> - Gear Ratio Simulator use and calculations - Scientific principles in unit content materials

Unit G cont.

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Gain familiarity with factors and multiples	- Gear Ratio and Reduction
4.NBT	4	Number and Operations in Base Ten	Use place value understanding and properties of operations to perform multi-digit arithmetic.	- Gear Ratio and Reduction
4.NF	4	Number and Operations - Fractions	Extend understanding of fraction equivalence and ordering.	- Gear Ratio and Reduction
6.RP	6	Ratios and Proportional Relationships	Understand ratio concepts and use ratio reasoning to solve problems.	- Gear Ratio and Reduction
6.NS	6	The Number System	Compute fluently with multi-digit numbers and find common factors and multiples.	- Compound Gear Reduction

Unit H: Highrise Challenge

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
4	Energy	4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	- Challenge Robot Build - Idea Book Pages/ Engineering Notebook
4	Energy	4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	- Challenge Robot Build - Idea Book Pages/ Engineering Notebook
3-5	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.	- Challenge Robot Build - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
3-5	Engineering Design	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.	- Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
3-5	Engineering Design	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.	- Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
6-8	Energy	MS-PS3-5	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.	- Challenge Robot Build - Idea Book Pages/ Engineering. Notebook
6-8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	- Challenge Robot Build - Idea Book Pages/ Engineering. Notebook
6-8	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	- Challenge Robot Build - Idea Book Pages/ Engineering. Notebook
6-8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	- Challenge Robot Build - Idea Book Pages/ Engineering. Notebook

Unit H cont.

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
2.G	3-5	Students will develop an understanding of the characteristics and scope of technology.	When parts of a system are missing, it may not work as planned.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
2.L	3-5	Students will develop an understanding of the characteristics and scope of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
2.Q	6-8	Students will develop an understanding of the characteristics and scope of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
2.R	6-8	Students will develop an understanding of the characteristics and scope of technology.	Requirements are the parameters placed on the development of a product or system.	<ul style="list-style-type: none"> - Following Challenge Rules
2.U	6-8	Students will develop an understanding of the characteristics and scope of technology.	Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	<ul style="list-style-type: none"> - Following Challenge Rules
8.F	6-8	Students will develop an understanding of the attributes of design.	There is no perfect design.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	<ul style="list-style-type: none"> - Following Challenge Rules

Unit H cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention and innovation are creative ways to turn ideas into real things.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook

Unit H cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
10.H	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Some technological problems are best solved through experimentation.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
11.F	3-5	Students will develop abilities to apply the design process.	Test and evaluate the solutions for the design problem.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
11.G	3-5	Students will develop abilities to apply the design process.	Improve the design solutions.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
4.MD	4	Measurement and Data	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
4.MD	4	Measurement and Data	Represent and interpret data.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
6.EE	6	Expressions and Equations	Represent and analyze quantitative relationships between dependent and independent variables.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
7.RP	7	Ratios and Proportional Relationships	Analyze proportional relationships and use them to solve real-world and mathematical problems.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook

Unit I: Smart Machines

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
3.5	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.	- Programming Exercises & Idea Book documentation
3.5	Engineering Design	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.	- Programming Exercises & Idea Book documentation

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	- Default Sensor Functionality Exercises - Programming Exercises - Idea Book Pages
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	- Default Sensor Functionality Exercises - Programming Exercises - Idea Book Pages
2.G	3-5	Students will develop an understanding of the core concepts of technology.	When parts of a system are missing, it may not work as planned.	- Programming Exercises and troubleshooting

Unit I cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
2.Q	6-8	Students will develop an understanding of the core concepts of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	- Programming Exercises and troubleshooting
2.R	6-8	Students will develop an understanding of the core concepts of technology.	Requirements are the parameters placed on the development of a product or system.	- Programming Exercises
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	- Idea Book Pages with Programming Exercises
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	- Programming Exercises
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	- Programming Exercises
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	- Programming Exercises and troubleshooting - Idea Book Pages
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	- Programming Exercises and troubleshooting - Idea Book Pages
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	- Programming Exercises and troubleshooting - Idea Book Pages
11.J	6-8	Students will develop abilities to apply the design process.	Make two-dimensional and three-dimensional representations of the designed solution.	- Programming Exercises and troubleshooting - Idea Book Pages
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	- Programming Exercises and troubleshooting - Idea Book Pages
11.L	6-8	Students will develop abilities to apply the design process.	Make a product or system and document the solution.	- Programming Exercises and troubleshooting - Idea Book Pages

Unit J: Chain Reaction Programming Challenge

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
4	Energy	4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	- Device Build(s) - Idea Book Pages
4	Energy	4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	- Device Build(s) - Idea Book Pages
3-5	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.	- Device Build(s) - Idea Book Pages - Following Challenge Rules
3-5	Engineering Design	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.	- Device Build(s) - Programming - Idea Book Pages - Following Challenge Rules
3-5	Engineering Design	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.	- Device Build(s) - Idea Book Pages - Following Challenge Rules
6-8	Energy	MS-PS3-5	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.	- Device Build(s) - Idea Book Pages
6-8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	- Device Build(s) - Programming - Idea Book Pages
6-8	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	- Device Build(s) - Idea Book Pages
6-8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	- Device Build(s) - Programming - Idea Book Pages

Unit J cont.

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
2.G	3-5	Students will develop an understanding of the characteristics and scope of technology.	When parts of a system are missing, it may not work as planned.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
2.L	3-5	Students will develop an understanding of the characteristics and scope of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
2.Q	6-8	Students will develop an understanding of the characteristics and scope of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
2.R	6-8	Students will develop an understanding of the characteristics and scope of technology.	Requirements are the parameters placed on the development of a product or system.	<ul style="list-style-type: none"> - Following Challenge Rules
2.U	6-8	Students will develop an understanding of the characteristics and scope of technology.	Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	<ul style="list-style-type: none"> - Following Challenge Rules
8.F	6-8	Students will develop an understanding of the attributes of design.	There is no perfect design.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages - Following Challenge Rules
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	<ul style="list-style-type: none"> - Following Challenge Rules

Unit J cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages - Following Challenge Rules
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	<ul style="list-style-type: none"> - Idea Book Pages
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	<ul style="list-style-type: none"> - Device Build(s) - Idea Book Pages
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention and innovation are creative ways to turn ideas into real things.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages

Unit J cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
10.H	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Some technological problems are best solved through experimentation.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
11.F	3-5	Students will develop abilities to apply the design process.	Test and evaluate the solutions for the design problem.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
11.G	3-5	Students will develop abilities to apply the design process.	Improve the design solutions.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Device Build(s) - Programming - Idea Book Pages

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	<ul style="list-style-type: none"> - Idea Book Pages
4.MD	4	Measurement and Data	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	<ul style="list-style-type: none"> - Idea Book Pages
4.MD	4	Measurement and Data	Represent and interpret data.	<ul style="list-style-type: none"> - Idea Book Pages
6.EE	6	Expressions and Equations	Represent and analyze quantitative relationships between dependent and independent variables.	<ul style="list-style-type: none"> - Idea Book Pages
7.RP	7	Ratios and Proportional Relationships	Analyze proportional relationships and use them to solve real-world and mathematical problems.	<ul style="list-style-type: none"> - Idea Book Pages

Unit K: Smarter Machines

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
4	Energy	4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	<ul style="list-style-type: none">- Challenge Build/ Programming- Idea Book Pages
3-5	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.	<ul style="list-style-type: none">- Challenge Build/ Programming- Idea Book Pages- Following Challenge Criteria
3-5	Engineering Design	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.	<ul style="list-style-type: none">- Challenge Build/ Programming- Idea Book Pages- Following Challenge Criteria
3-5	Engineering Design	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.	<ul style="list-style-type: none">- Challenge Build/ Programming- Idea Book Pages- Following Challenge Criteria
6.8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	<ul style="list-style-type: none">- Challenge Build/ Programming- Idea Book Pages- Following Challenge Criteria

Unit K cont.

Next Generation Science Standards (NGSS) - Continued

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
6.8	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
6.8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
2.G	3-5	Students will develop an understanding of the core concepts of technology.	When parts of a system are missing, it may not work as planned.	<ul style="list-style-type: none"> - Challenge Build/ Programming
2.L	3-5	Students will develop an understanding of the core concepts of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Following Challenge Criteria
2.Q	6-8	Students will develop an understanding of the core concepts of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	<ul style="list-style-type: none"> - Challenge Build/ Programming
2.R	6-8	Students will develop an understanding of the core concepts of technology.	Requirements are the parameters placed on the development of a product or system.	<ul style="list-style-type: none"> - Following Challenge Criteria
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria

Unit K cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design	- Following Challenge Criteria
8.F	6-8	Students will develop an understanding of the attributes of design.	There is no perfect design.	- Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
8.G	6-8	Students will develop an understanding of the attributes of design.	Requirements for a design are made up of criteria and constraints.	- Following Challenge Criteria
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	- Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	- Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	- Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	- Idea Book Pages
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	- Challenge Robot Build - Programming Activities - Idea book Pages
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention and innovation are creative ways to turn ideas into real things.	- Challenge Build/ Programming - Idea Book Pages/ Engineering Notebook

Unit K cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
10.H	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Some technological problems are best solved through experimentation.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
11.F	3-5	Students will develop abilities to apply the design process	Test and evaluate the solutions for the design problem.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
11.G	3-5	Students will develop abilities to apply the design process	Improve the design solutions.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
11.H	6-8	Students will develop abilities to apply the design process	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria
11.K	6-8	Students will develop abilities to apply the design process	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Challenge Build/ Programming - Idea Book Pages - Following Challenge Criteria

Unit K cont.

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	- Idea Book Pages
4.MD	4	Measurement and Data	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	- Idea Book Pages
4.MD	4	Measurement and Data	Represent and interpret data.	- Idea Book Pages
6.EE	6	Expressions and Equations	Represent and analyze quantitative relationships between dependent and independent variables.	- Idea Book Pages
7.RP	7	Ratios and Proportional Relationships	Analyze proportional relationships and use them to solve real-world and mathematical problems.	- Idea Book Pages

Unit L: Highrise Programming Challenge

Unit Standards Connections:

Next Generation Science Standards (NGSS)

Grade	Category	PE Code	Performance Expectation (PE)	Unit Activities
4	Energy	4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
4	Energy	4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
3-5	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.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
3-5	Engineering Design	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.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
3-5	Engineering Design	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.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
6-8	Energy	MS-PS3-5	Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
6-8	Engineering Design	MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
6-8	Engineering Design	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
6-8	Engineering Design	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook

Unit L cont.

Standards for Technological Literacy (STL)

Code	Grade	Standard	Benchmark	Unit Activities
1.D	3-5	Students will develop an understanding of the characteristics and scope of technology.	Tools, materials, and skills are used to make things and carry out tasks.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
1.F	6-8	Students will develop an understanding of the characteristics and scope of technology.	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
1.G	6-8	Students will develop an understanding of the characteristics and scope of technology.	The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
2.G	3-5	Students will develop an understanding of the core concepts of technology.	When parts of a system are missing, it may not work as planned.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
2.L	3-5	Students will develop an understanding of the core concepts of technology.	Requirements are the limits to designing or making a product or system.	<ul style="list-style-type: none"> - Challenge Robot Build - Idea Book Pages/ Engineering Notebook
2.Q	6-8	Students will develop an understanding of the core concepts of technology.	Malfunctions of any part of a system may affect the function and quality of the system.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
2.R	6-8	Students will develop an understanding of the core concepts of technology.	Requirements are the parameters placed on the development of a product or system.	<ul style="list-style-type: none"> - Following Challenge Rules
2.U	6-8	Students will develop an understanding of the core concepts of technology.	Maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
8.C	3-5	Students will develop an understanding of the attributes of design.	The design process is a purposeful method of planning practical solutions to problems.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
8.D	3-5	Students will develop an understanding of the attributes of design.	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.	<ul style="list-style-type: none"> - Following Challenge Rules
8.F	6-8	Students will develop an understanding of the attributes of design.	There is no perfect design.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook - Following Challenge Rules

Unit L cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
9.C	3-5	Students will develop an understanding of engineering design.	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook - Following Challenge Rules
9.D	3-5	Students will develop an understanding of engineering design.	When designing an object, it is important to be creative and consider all ideas.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
9.F	6-8	Students will develop an understanding of engineering design.	Design involves a set of steps, which can be performed in different sequences and repeated as needed.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
9.G	6-8	Students will develop an understanding of engineering design.	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	<ul style="list-style-type: none"> - Idea Book Pages/ Engineering Notebook
10.C	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a way of finding out why something does not work so that it can be fixed.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
10.D	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention and innovation are creative ways to turn ideas into real things.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
10.E	3-5	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	The process of experimentation, which is common in science, can also be used to solve technological problems.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/ Engineering Notebook
10.F	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook
10.G	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook

Unit L cont.

Standards for Technological Literacy (STL) - Continued

Code	Grade	Standard	Benchmark	Unit Activities
10.H	6-8	Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	Some technological problems are best solved through experimentation.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook
11.F	3-5	Students will develop abilities to apply the design process.	Test and evaluate the solutions for the design problem.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook
11.G	3-5	Students will develop abilities to apply the design process.	Improve the design solutions.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook
11.H	6-8	Students will develop abilities to apply the design process.	Apply a design process to solve problems in and beyond the laboratory-classroom.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook
11.K	6-8	Students will develop abilities to apply the design process.	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.	<ul style="list-style-type: none"> - Challenge Robot Build - Programming Activities - Idea Book Pages/Eng Notebook

Common Core Standards for Mathematics (CCSM)

Domain #	Grade	Cluster	Standard	Unit Activities
4.OA	4	Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	<ul style="list-style-type: none"> - Idea Book Pages/Engineering Notebook
4.MD	4	Measurement and Data	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	<ul style="list-style-type: none"> - Idea Book Pages/Engineering Notebook
4.MD	4	Measurement and Data	Represent and interpret data.	<ul style="list-style-type: none"> - Idea Book Pages/Engineering Notebook
6.EE	6	Expressions and Equations	Represent and analyze quantitative relationships between dependent and independent variables.	<ul style="list-style-type: none"> - Idea Book Pages/Engineering Notebook
7.RP	7	Ratios and Proportional Relationships	Analyze proportional relationships and use them to solve real-world and mathematical problems.	<ul style="list-style-type: none"> - Idea Book Pages/Engineering Notebook