HILLSBOROUGH TOWNSHIP SCHOOL DISTRICT

SCIENCE CURRICULUM

INTRODUCTION TO ENGINEERING

AUGUST 2021

Unit Title	**Time Frame/Pacing**
Introduction to Engineering	2-3 weeks

Phenomena/Anchoring Activity/Anchoring Question/Essential Questions

Phenomena:
- Climbing the Burj Khalifa
- Mjøstårnet is a 280 foot timber-framed skyscraper

Anchoring Activity:
- Tall Towers I, II and III (progressive projects)

Essential Questions:
- How was the tallest building in the world constructed?
- How are all major buildings constructed today?
- What fundamental details have to be taken into consideration when constructing a skyscraper?

Enduring Understandings

- How do engineers identify a problem and go about finding a solution?
- Engineers follow a predetermined process (which can vary) to identify, diagnose and solve problems, unusually with other engineers.

NJ Standards/NGSS Performance Expectations Taught and Assessed
Students who demonstrate understanding can:

- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

3-Dimensional Learning Components

Science and Engineering Practices	**Disciplinary Core Ideas (DCI)**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions • Design, evaluate, and/or refine a solution to	**ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include	**Cause and Effect** • Cause and effect relationships can be suggested and predicted for complex

a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Engaging in Argument from Evidence** ● Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. **Obtaining, Evaluating, and Communicating Information** ● Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.	satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) ● Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1) **ETS1.B: Developing Possible Solutions** ● When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	natural and human designed systems by examining what is known about smaller scale mechanisms within the system. **Scale, Proportion, and Quantity** ● The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) ● Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). **Systems and System Models** ● When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. ● Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Stability and Change** ● Systems can be designed for greater or lesser stability. **Energy and Matter** ● Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.

		• Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Interdisciplinary Connections: Math, ELA, and Computer Science and Design Thinking

Math

- MP.2 Reason abstractly and quantitatively.

ELA

- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Computer Science and Design Thinking

- 8.2.12.ED.2 Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3 Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.NT.2 Redesign an existing product to improve form or function.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).
- 9.4.12.GCA.1 Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Social-Emotional Learning Competencies

- **Self Awareness** :Recognize the impact of one's feelings and thoughts on one's own behavior
- **Responsible Decision-Making:** Develop, implement, and model effective problem-solving and critical thinking skills
- **Relationship Skills**: Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways

Learning Targets	Investigations/Resources	Formative Assessment

Work together to identify and discuss the optimal way to construct a freestanding tower made from a fixed supply of materials.	Joe McNally Photography- Climbing the Burj Khalifa (The World's Tallest Building)	Tall Towers I, II and III Planning Diagrams
Build the tallest but stable tower possible with challenges that progress requiring more and more engineering adaptation.	Extreme Engineering Try Engineering	Tall Tower I (tallest tower made from a fixed number of printer paper) Tall Tower II (tallest tower made from a fixed number of printer paper supporting a 1 kg mass) Tall Tower III (tallest tower made from a fixed number pipe cleaners and paper clips while supporting a golf ball)

Instructional Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)
Individual accommodations and modifications in students' IEP and 504's will be followed and adhered to. Along with this: • Group work and projects in this unit will be designed to allow the struggling learners to scaffold their learning and develop skills for working on larger projects by breaking down tasks. All students will be given opportunities to use different learning modalities to advance their understanding using varied strategies that accentuate their own learning style. Gifted learners will have the opportunity to challenge their problem solving skills by asking more complex questions and exploring concepts in greater depth.

Common Assessment(s)	**Assessment Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)**
• Tall Tower Summative	• All assessments will be modified in accordance with specifications from CST as enumerated in each student's educational plan. This may include, but is not limited to, extra time, clarification of questions, reading questions aloud, word banks, and alternate testing sites.

Hillsborough Township Public Schools
Introduction to Engineering Principles

Unit Title	Time Frame/Pacing
The Engineering Design Process	6-8 weeks (depending on the number of projects)

Phenomena/Anchoring Activity/Anchoring Question/Essential Questions

Phenomena:
- Our world is filled with machines designed to do specific tasks

Anchoring Activity:
- Discuss with a classmate about what annoys them in their daily routine. Could there be a better way of doing things? Is there something you can improve or create to make that task easier?

Essential Questions:
- What is the engineering design process?
- How does an engineer transform an idea into a product?
- Why do engineers and designers strive to improve products used in our daily lives?
- Why do we use the engineering design process to solve design challenges?
- How can the engineering design process benefit us in solving problems in our daily lives?

Enduring Understandings

- The engineering design process is a process that is used to solve technological challenges to change and improve products for the way we live.
- The Process can take on many forms, iterations, or modifications. The important point is that it is established, agreed upon, and adhered to.

NJ Standards/NGSS Performance Expectations Taught and Assessed
Students who demonstrate understanding can:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

3-Dimensional Learning Components		
Science and Engineering Practices	**Disciplinary Core Ideas (DCI)**	**Crosscutting Concepts**
Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. **Using Mathematics and Computational Thinking** • Create a computational model or simulation of a phenomenon, designed device, process, or system. **Constructing Explanations and Designing Solutions** • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	**ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1) **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • Systems can be designed to cause a desired effect. **Systems and System Models** • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. **Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

	making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4) **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)	

Interdisciplinary Connections: Math, ELA, and Computer Science and Design Thinking

Math
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.

ELA
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Computer Science and Design Thinking
- 8.2.12.ED.2 Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3 Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.NT.2 Redesign an existing product to improve form or function.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).
- 9.4.12.GCA.1 Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Social-Emotional Learning Competencies		
• **Self Management:** Recognize the skills needed to establish and achieve personal and educational goals • **Responsible Decision-Making:** Develop, implement, and model effective problem-solving and critical thinking skills		
Learning Targets	**Investigations/Resources**	**Formative Assessment**
Explore the design process that guides professionals from different careers areas.	Teach Engineering.org National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Step I Packet
List and provide examples of the steps of the design process used by engineers. (e.g., Ask: identify the problem, needs and constraints, research problem, imagine: develop possible solutions, plan: select a promising solution, create: build a model or prototype, test and evaluate prototype, improve: redesign as needed).	Teach Engineering.org National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Step II Packet
Compare and contrast the engineering design process and the scientific process.	Teach Engineering.org National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Step III Packet
Research the types of problems engineers seek to resolve.	Teach Engineering.org National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for	Step IV and V Packets

	Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	
Generate engineering sketches, and detailed views leading to complete engineering drawings.	Teach Engineering.org National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Step VI Packet

Instructional Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)

Individual accommodations and modifications in students' IEP and 504's will be followed and adhered to. Along with this:

- Group work and projects in this unit will be designed to allow the struggling learners to scaffold their learning and develop skills for working on larger projects by breaking down tasks. All students will be given opportunities to use different learning modalities to advance their understanding using varied strategies that accentuate their own learning style. Gifted learners will have the opportunity to challenge their problem solving skills by asking more complex questions and exploring concepts in greater depth.

Common Assessment(s)	**Assessment Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)**
• Engineering Design Process Test • Engineering Design Process Team Presentation	• All assessments will be modified in accordance with specifications from CST as enumerated in each student's educational plan. This may include, but is not limited to, extra time, clarification of questions, reading questions aloud, word banks, and alternate testing sites.

Unit Title	**Time Frame/Pacing**
Exploring Design in Mechanical Engineering	2-3 weeks (depending on the number of projects)

Phenomena/Anchoring Activity/Anchoring Question/Essential Questions

Phenomena:
- The energy stored in a common mousetrap

Anchoring Activity:
- Learn how to set and trip a mousetrap (it is not so easy...and can be painful if you do it incorrectly!)

Essential Questions:
- How does an engineer use the conservation of energy?
- How can we reduce kinetic friction to avoid generating thermal energy in a vehicle?

Enduring Understandings

- Engineers use less useful types of energy and convert them into more useful types of energy.
- Making a more efficient vehicle means reducing the production of less useful energy.
- All forms of energies have their limits.

NJ Standards/NGSS Performance Expectations Taught and Assessed
Students who demonstrate understanding can:

- Physics: HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

3-Dimensional Learning Components

Science and Engineering Practices	**Disciplinary Core Ideas (DCI)**	**Crosscutting Concepts**
Developing and Using Models • Develop and use a model based on evidence to illustrate the relationships between	**PS3.A: Definitions of Energy** • At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific

systems or between components of a system. **Planning and Carrying Out Investigations** • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. **Using Mathematics and Computational Thinking** • Create a computational model or simulation of a phenomenon, designed device, process, or system.	**PS3.D: Energy in Chemical Processes** • Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. **ETS1.A: Defining and Delimiting an Engineering Problem** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.	causes and effects. • Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. • Systems can be designed to cause a desired effect. **Systems and System Models** • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. **Stability and Change** • Systems can be designed for greater or lesser stability.

Interdisciplinary Connections: Math, ELA, and Computer Science and Design Thinking

Math
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.

ELA
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Computer Science and Design Thinking

- 8.2.12.ED.2 Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3 Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.NT.2 Redesign an existing product to improve form or function.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).
- 9.4.12.GCA.1 Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Social-Emotional Learning Competencies

- **Self Awareness**
  - Recognize one's feelings and thoughts
  - Recognize one's personal traits, strengths, and limitations
- **Self Management:** Understand and practice strategies for managing one's own emotions, thoughts, and behaviors

Learning Targets	Investigations/Resources	Formative Assessment
The Conservation of Energy - Describe what types of energy are used during the limited energy car's trip. Construct an explanation for how the transfer of energy is used to optimize the operation of the vehicle.	Mousetrap Car Project	Mousetrap Car Planning Packet Warm-up activities, exploratory activities, class discussions, student participation, quizzes, design briefs, sketches, inventor research, benchmark assessments.
Friction - Construct an explanation that describes the factors that affect friction and how to reduce the work done by friction in an automobile.	Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Friction Review Packet

Instructional Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)

Individual accommodations and modifications in students' IEP and 504's will be followed and adhered to. Along with this:

- Group work and projects in this unit will be designed to allow the struggling learners to scaffold their learning and develop skills for working on larger projects by breaking down tasks. All students will be given opportunities to use different learning modalities to advance their understanding using

varied strategies that accentuate their own learning style. Gifted learners will have the opportunity to challenge their problem solving skills by asking more complex questions and exploring concepts in greater depth.	
Common Assessment(s)	**Assessment Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)**
• Mousetrap Team Competition (Distance)	• All assessments will be modified in accordance with specifications from CST as enumerated in each student's educational plan. This may include, but is not limited to, extra time, clarification of questions, reading questions aloud, word banks, and alternate testing sites.

Hillsborough Township Public Schools
Introduction to Engineering Principles

Unit Title	Time Frame/Pacing
Exploring Design in Electrical Engineering	2-3 weeks (depending on the number of projects)

Phenomena/Anchoring Activity/Anchoring Question/Essential Questions

Phenomena:
- The energy stored in common electrical devices

Anchoring Activity:
- Learn how to make a simple flashlight.

Essential Questions:
- How does an engineer use and apply the principle of the conservation of energy to electronic devices?
- How can we apply the practice of reverse engineering to analyze a working electronic device?

Enduring Understandings

- Engineers use less useful types of energy and convert them into more useful types of energy.
- Our dependence upon electricity in our modern society cannot be overstated.
- All forms of energies have their limits.

NJ Standards/NGSS Performance Expectations Taught and Assessed
Students who demonstrate understanding can:

- HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

3-Dimensional Learning Components

Science and Engineering Practices	Disciplinary Core Ideas (DCI)	Crosscutting Concepts
Asking Questions and Defining Problems • Analyze complex real-world problems by specifying criteria and constraints for successful solutions.	**ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include satisfying any requirements set by society,	**Cause and Effect** • Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by

Using Mathematics and Computational Thinking • Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. **Constructing Explanations and Designing Solutions** • Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.	such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.	examining what is known about smaller scale mechanisms within the system. **Systems and System Models** • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Stability and Change** • Systems can be designed for greater or lesser stability. **Energy and Matter** • Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. • Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Interdisciplinary Connections: Math, ELA, and Computer Science and Design Thinking
Math • MP.2 Reason abstractly and quantitatively. • MP.4 Model with mathematics.

ELA

- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Computer Science and Design Thinking

- 8.2.12.ED.2 Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ED.3 Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
- 8.2.12.NT.2 Redesign an existing product to improve form or function.

Career Readiness, Life Literacies, and Key Skills

- 9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12 prof.CR3a).
- 9.4.12.GCA.1 Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Social-Emotional Learning Competencies

- **Responsible Decision-Making**
  - Develop, implement, and model effective problem-solving and critical thinking skills
  - Identify the consequences associated with one's actions in order to make constructive choices
- **Relationship Skills**: Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways

Learning Targets	Investigations/Resources	Formative Assessment
List and provide examples of the steps of the design process used by engineers. (e.g., Ask: identify the problem, needs and constraints, research problem, imagine: develop possible solutions, plan: select a promising solution, create: build a model or prototype, test and evaluate prototype, improve: redesign as needed).	National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). Eugene, OR: International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Warm-up activities, exploratory activities, class discussions, student participation, quizzes, design briefs, sketches, inventor research, benchmark assessments.

Compare and contrast the engineering design process and the scientific process.	International Society for Technology in Education, Project Lead The Way curriculum: The Way Things Work, multimedia resources	Exploratory activities, class discussions, student participation, quizzes, design briefs, sketches, inventor research, benchmark assessments.
Generate engineering sketches, and detailed views leading to complete engineering drawings.	Project Lead The Way curriculum: The Way Things Work, multimedia resources	Design briefs, sketches, inventor research, benchmark assessments.
Understand some career opportunities for electrical engineers.	The Way Things Work, multimedia resources	Design briefs, sketches, inventor research, benchmark assessments.

Instructional Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)

Individual accommodations and modifications in students' IEP and 504's will be followed and adhered to. Along with this:

- Group work and projects in this unit will be designed to allow the struggling learners to scaffold their learning and develop skills for working on larger projects by breaking down tasks. All students will be given opportunities to use different learning modalities to advance their understanding using varied strategies that accentuate their own learning style. Gifted learners will have the opportunity to challenge their problem solving skills by asking more complex questions and exploring concepts in greater depth.

Common Assessment(s)	Assessment Modifications and/or Accommodations (ELL, Special Education, Gifted, At-Risk of Failure, 504)
• Electric Circuit Practical	• All assessments will be modified in accordance with specifications from CST as enumerated in each student's educational plan. This may include, but is not limited to, extra time, clarification of questions, reading questions aloud, word banks, and alternate testing sites.