CURRICULUM

FOR

STEM

GRADE 7

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Dr. Susan Dube, Program Supervisor of Math, Science, and Technology Education

The Board acknowledges the following who contributed to the preparation of this curriculum.

Doris C. Jones

Dr. Tiffany A. Beer, Director of Curriculum and Instruction

Subject/Course Title:
STEM
Grade 7

Date of Board Adoption:
September 19, 2023

RAHWAY PUBLIC SCHOOLS CURRICULUM

STEM: Grade 7

PACING GUIDE

Unit	Title	Pacing
1	Engineering Design Process	1 week
2	Environmental Engineering	3 weeks
3	Renewable Energy	6 weeks

ACCOMMODATIONS

504 Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Provide extra visual and verbal cues and prompts.
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages).
- Provide study sheets and teacher outlines prior to assessments.
- Quiet corner or room to calm down and relax when anxious.
- Reduction of distractions.
- Permit answers to be dictated.
- Hands-on activities.
- Use of manipulatives.
- Assign preferential seating.
- No penalty for spelling errors or sloppy handwriting.
- Follow a routine/schedule.
- Provide student with rest breaks.
- Use verbal and visual cues regarding directions and staying on task.
- Assist in maintaining agenda book.

IEP Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Differentiate reading levels of texts (e.g., Newsela).
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide extra visual and verbal cues and prompts.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Provide students with additional information to supplement notes.
- Modify questioning techniques and provide a reduced number of questions or items on tests.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Provide study sheets and teacher outlines prior to assessments.
- Use of manipulatives.
- Have students work with partners or in groups for reading, presentations, assignments, and analyses.
- Assign appropriate roles in collaborative work.
- Assign preferential seating.
- Follow a routine/schedule.

Gifted and Talented Accommodations:

- Differentiate reading levels of texts (e.g., Newsela).
- Offer students additional texts with higher lexile levels.
- Provide more challenging and/or more supplemental readings and/or activities to deepen understanding.
- Allow for independent reading, research, and projects.
- Accelerate or compact the curriculum.
- Offer higher-level thinking questions for deeper analysis.
- Offer more rigorous materials/tasks/prompts.
- Increase number and complexity of sources.
- Assign group research and presentations to teach the class.
- Assign/allow for leadership roles during collaborative work and in other learning activities.

ML Accommodations:

- Provide extended time.
- Assign preferential seating.
- Assign peer buddy who the student can work with.
- Check for understanding frequently.
- Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc…).
- Have student repeat directions.
- Make vocabulary words available during classwork and exams.
- Use study guides/checklists to organize information.
- Repeat directions.
- Increase one-on-one conferencing.
- Allow student to listen to an audio version of the text.
- Give directions in small, distinct steps.
- Allow copying from paper/book.
- Give student a copy of the class notes.

	● Provide written and oral instructions. ● Differentiate reading levels of texts (e.g., Newsela). ● Shorten assignments. ● Read directions aloud to student. ● Give oral clues or prompts. ● Record or type assignments. ● Adapt worksheets/packets. ● Create alternate assignments. ● Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. ● Allow student to resubmit assignments. ● Use small group instruction. ● Simplify language. ● Provide scaffolded vocabulary and vocabulary lists. ● Demonstrate concepts possibly through the use of visuals. ● Use manipulatives. ● Emphasize critical information by highlighting it for the student. ● Use graphic organizers. ● Pre-teach or pre-view vocabulary. ● Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. ● Provide audio versions of the textbooks. ● Highlight textbooks/study guides. ● Use supplementary materials. ● Give assistance in note taking ● Use adapted/modified textbooks. ● Allow use of computer/word processor. ● Allow student to answer orally, give extended time (time-and-a-half). ● Allow tests to be given in a separate location (with the ESL teacher). ● Allow additional time to complete assignments and/or assessments. ● Read question to student to clarify. ● Provide a definition or synonym for words on a test that do not impact the validity of the exam. ● Modify the format of assessments. ● Shorten test length or require only selected test items. ● Create alternative assessments. ● On an exam other than a spelling test, don’t take points off for spelling errors.

UNIT OVERVIEW

Content Area: STEM

Unit Title: Engineering Design Process

Target Course/Grade Level: 7

Unit Summary:

Students will develop a deep understanding of the engineering design process and its real-world applications. They will gain hands-on experience in collaborative problem-solving, critical thinking, and creativity while exploring the iterative nature of engineering. This unit will empower students to approach challenges with an engineering mindset and appreciate the value of innovation and teamwork in addressing complex problems. Students will apply the engineering design process to understand and solve engineering design problems.

Approximate Length of Unit: 1 Week

LEARNING TARGETS

NJ Student Learning Standards:
Science

MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]

MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium.

Engineering Design:

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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.

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**.**

Career Readiness, Life Literacies, and Key Skills:

9.4.7.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.

9.4.7.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process.

Interdisciplinary Connections and Standards:

Literacy

L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.

SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

W.7.1 Write arguments to support claims with clear reasons and relevant evidence.

Technology:

8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

Social Studies, Science, and Technical Subjects ELA Companion Standards

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Unit Understandings:

Students will understand that…

- Engineering is a systematic problem-solving process that involves identifying needs, designing solutions, building prototypes, testing, and improving upon them.
- Collaboration and communication are essential in the engineering design process to generate innovative and effective solutions.
- Iteration and continuous improvement are integral to engineering, as solutions evolve based on testing and feedback.
- The engineering design process can be applied to a wide range of real-world challenges, from simple tasks to complex problems.

Unit Essential Questions:

- What is the engineering design process, and how does it work?
- How does collaboration enhance the quality of engineering solutions?
- Why is it important to iterate and improve designs during the engineering process?
- How can we apply the engineering design process to address real-world problems?

Knowledge and Skills:

Students will be able to...

- Students will employ brainstorming techniques to generate multiple ideas for potential solutions to the design challenge.

- Students will evaluate the feasibility and viability of their ideas based on the design brief.
- Students will use various materials and tools to create physical prototypes of their proposed solutions.
- Students will iterate on their prototypes to improve functionality and address potential issues.
- Students will conduct testing on their prototypes, collecting data to evaluate their effectiveness and efficiency.
- Students will analyze the test results and identify areas for improvement.
- Iterate and Improve Designs:
- Students will use the feedback from testing to make iterative improvements to their prototypes.
- Students will reflect on their design choices and make adjustments to enhance the final solutions.
- Students will communicate their design process and final solutions to the class through presentations or demonstrations.
- Students will articulate the rationale behind their design decisions and the lessons learned during the engineering process.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Engineering Design Process Quiz

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- (Ex. students create a "table" out of 10 sheets of newspaper and scotch tape that is able to hold a textbook. Constraints are then applied (specifying the required height) and students revise their initial designs to meet the criteria and constraints. Additional constraint is applied that students can only utilize a specific length of scotch tape. Students will revise and redesign their "tables" to meet the new constraints.
    - Emergency Shelter (or)
    - Design and construct an emergency shelter using limited materials to protect from specific weather conditions (e.g., rain, wind). (or)
    - Design and build a vertical gardening system using recycled materials to maximize plant growth in limited space.

RESOURCES

Teacher Resources:

Science Buddies: Engineering Design Process

Equipment Needed:

- Chromebooks

- Projector with Computer
- Dry Erase Markers
- Project materials for prototype
- Notebooks
- Pencils and Erasers
- Ruler
- Scizzors
- Tape or Glue

UNIT OVERVIEW

Content Area: STEM

Unit Title: Environmental Engineering

Target Course/Grade Level: 7

Unit Summary:

This curriculum unit will teach 7th grade students about the Great Pacific Garbage Patch. Students will research the causes and impacts of the garbage patch, and they will create a public service announcement to raise awareness about the issue. Students will be able to explain the causes and impacts of the Great Pacific Garbage Patch, identify ways to reduce their own plastic consumption. Students will apply the engineering design process to understand and solve environmental questions.

Approximate Length of Unit: 2 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Science:

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically nonrenewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating

solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused climate change over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

Engineering Design:

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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.

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**.**

Career Readiness, Life Literacies, and Key Skills:

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective.

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.

9.4.8.CT.3: Compare past problem-solving solutions to local, national or global issues and analyze the factors that led to a positive or negative outcome.

Interdisciplinary Connections and Standards:

Literacy:

L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.

SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

W.7.1 Write arguments to support claims with clear reasons and relevant evidence.

Social Studies, Science, and Technical Subjects ELA Companion Standards

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Unit Understandings:

Students will understand that…

- The Engineering Design Process is a tool used by engineers to solve problems.
- All water is not safe for consumption and this causes major problems globally.
- Exploration of the Great Pacific Garbage Patch (GPGP) can give students insight into aspects of chemistry, oceanography, environmental science, life science, and international policy.
- There are many solutions to one problem.

Unit Essential Questions:

- How can we protect the environment from humans?
- How can we protect humans from the environment?
- How can we improve the overall quality of the world around us?

Knowledge and Skills:

Students will be able to...

- Be able to discuss two or three major environmental impacts of ocean pollution and brainstorm solutions to solve related problems.
- Be able to demonstrate their understanding of the importance of clean water consumption.
- Be able to discern the efficiency of various filter materials on contaminated water.
- Be able to articulate their process and findings through written documentation and oral presentation.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Especially after showing the suggested videos to students, ask them questions, such as those listed below. Their responses, particularly to questions about the GPGP cause, reveal whether or not they are grasping the issue.
    - Why is so much trash out in the middle of the ocean and thousands of miles from land?
    - How does human consumerism contribute to this?
    - Would the patch be smaller if we recycled more?
    - What is that trash mostly made of?
    - How do plastics and trash get from your yard all the way to the mid-Pacific Ocean?
    - What are some major problems with the GPGP?
    - Why is it that the patch does not collect banana peels, but instead collects plastic?
    - What type of information would environmental engineers need to collect about the GPGP in order to start to solve the problem?

    - Tie-in for GIS If I wanted to use GIS to communicate to someone about the GPGP, how could I do it?
- As an alternative, use these questions as a short-answer essay assignment to assess independent thinking on the part of the students rather than class discussion and cooperative thinking. Have students construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. Additionally, have them further analyze the cause and effect of the GPCP.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Plastic in the Ocean: Get the Word Out at McDonalds! - Through a hypothetical scenario, students are challenged to inform customers at a local restaurant of how their use and disposal of plastics relates/contributes to the Great Pacific Garbage Patch (GPGP). To do this, they research the GPGP and present that information in eye-catching newsletter handouts to customers. This activity focuses on teaching students to conduct online research to gather information on a science-technology related topic and present it in an informative manner that includes source crediting without plagiarism.
- Where Are the Plastics Near Me? (Field Trip) - On a field trip, student investigation teams catalog the incidence of plastic debris in various environments. They sort by type, age, location and other characteristics, collecting qualitative and quantitative data suitable for creating their own Google Earth layer.
- Where Are the Plastics Near Me? (Mapping the Data) - Student teams organize field trip data (collected in a previous activity) to create a useful and informative Google Earth maps. They create a map, use that map to analyze the results, adjust the map to include the results of the analysis, and then write a brief summary of their findings. Questions of fate-and-transport of plastics are primarily what are explored.

RESOURCES

Teacher Resources:

- “The Great Pacific Garbage Patch” from Teachengineering.org.
- Plastic Pollution Video
- *Good Morning America* special on the GPGP: https://www.schooltube.com/video/c412e0e5292291dbd194/The-Great-Pacific-Garbage-Patch-Good-Morning-America
- Associated Press' "Disney's House of the Future" video c. 1957 (57 seconds): https://www.youtube.com/watch?v=1NQ5OlY40bA
- HowStuffWorks Show: Episode 1: Corn Plastic video: https://www.youtube.com/watch?v=jwc-n3W9rNY
- "More Plastics Gain Popularity" 1950s video: http://www.babelgum.com/112076/plastics-gain-popularity.html

Equipment Needed:

- Chromebooks
- Projector with Computer
- Dry Erase Markers

- Notebooks
- Pencils and Erasers

UNIT OVERVIEW

Content Area: STEM

Unit Title: Renewable Energy

Target Course/Grade Level: 7

Unit Summary:

In this unit, students will learn about the positive and negative impacts of renewable and non-renewable energy resources. They will also learn about the different ways to generate and use energy. By the end of the unit, students will be able to draw conclusions about the best way to meet our energy needs in a sustainable way.

As a culminating activity, students will create a solar powered vehicle technical drawing. The drawing will be based on specific constraints provided by the teacher. Students will need to consider the constraints provided, and efficiency of the vehicle when creating their drawing. This unit will help students to develop their understanding of energy, sustainability, and engineering. It will also help them to develop their critical thinking and problem-solving skills. Students will apply the engineering design process, various skills learned throughout the course, and sustainable investigation to develop a renewable energy solution.

Approximate Length of Unit: 3 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Science

MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]

MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]

MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

MS-PS1-5 Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]

MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium

Engineering Design:

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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.

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**.**

Career Readiness, Life Literacies, and Key Skills:

9.3.ST-ET.5: Apply the knowledge learned in STEM to solve problems.

9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

9.3.ST-SM.3: Analyze the impact that science and mathematics has on society.

Social Studies, Science, and Technical Subjects ELA Companion Standards

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Interdisciplinary Connections and Standards:

Technology

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Literacy:

L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.

SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

W.7.1 Write arguments to support claims with clear reasons and relevant evidence.

Unit Understandings:
Students will understand that…

- The Engineering Design Process is a tool used by engineers to solve problems.
- There are many solutions to one problem.
- Students will explore the different forms of alternative energy and the implications energy sources have on the Earth.
- Students will examine the positive and negative aspects of both renewable and nonrenewable energy.
- An electrical connection requires a circular path through conductive material.
- Using the tools and skills developed throughout the course, students will apply all knowledge to building some type of solar powered tool.

Unit Essential Questions:

- What are the different forms of energy?
- What is the difference between renewable and nonrenewable?
- How do solar panels work?

Knowledge and Skills:
Students will be able to...

- Be able to delineate between renewable and nonrenewable energy sources.
- Be able to draw conclusions about the positive and negative impacts that renewable and nonrenewable energy has on the Earth.
- Be able to describe, demonstrate, and assess the way solar panels work.
- Be able to create a technical drawing of their model solar powered vehicle.
- Be able to apply and practice safe lab skills when constructing a solar powered vehicle based on given constraints.
- Be able to articulate their process and findings through written documentation and oral presentation.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Questions: Ask students to answer the following questions in writing in order to gauge their comprehension:
  - Did the angle of the solar panel affect the performance of your car? Why?
  - How does the sun power your car? Please explain each step.
  - As a class, create a histogram of the solar car results. Discuss the distribution, and what factors affect how fast each solar car travels.

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Solar Car Handout

- Energy of sunlight is transferred to electrons, allowing them to jump to the next orbital and cross the band gap. These electrons are now mobile and current will flow.
- Use the Photovoltaic Cell Handout for diagrams and an explanation of how photovoltaic cells work, including their design (layers, materials) and functionality. Following the handout, have students complete the hands-on Racing with the Sun - Creating a Solar Car activity.
- For a more detailed understanding of photovoltaic cells, please see http://science.howstuffworks.com/solar-cell.htm.

RESOURCES

Teacher Resources:

- Race the Sun Movie
- Junior Solar Sprint Activity

Equipment Needed:

- Chromebooks
- Projector with Computer
- Dry Erase Markers
- Notebooks
- Pencils and Erasers