Unit 4: Environmental Engineering and Design

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **14-21 Days**
Status: **Published**

Summary

Students will work through the Engineering Design Process as they develop a solution to a given problem with respect to criteria and specifications of the challenge given. In this unit, students will gain an understanding of some of the environmental challenges that we face in our world at present and those that we may need to solve as we move forward. Students will explore the environmental impacts of our technologies and design and develop ways to counteract the effects on our planet. Students will explore how their designs positively impact the environment and the effects on climate change.

Revision Date: July 2026

L.SS.8.1	Demonstrate command of the system and structure of the English language when writing or speaking.
9.2.8.CAP.1	Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.
9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
L.KL.8.2	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.VL.8.3	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, including technical meanings, choosing flexibly from a range of strategies.
9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
TECH.K-12.1.4.d	exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.
8.2.8.ED.1	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ETW.1	Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs.
8.2.8.ETW.2	Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).
8.2.8.ETW.3	Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
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.

Essential Questions/Enduring Understandings

Essential Questions

Why should engineers follow the engineering design process?

How will the use of alternative energy sources help our environment?

How can we design houses to passively use the "free" energy from the sun for heating?

Why should we continue to explore alternative energy sources?

Enduring Understandings

Environmental engineering is an area in which engineers work to develop methods that will utilize our natural resources to design solutions to environmental issues.

It is important to consider alternative energy sources in design, from infrastructure to homes to basic product creation.

Objective

Students will know the vocabulary relevant to environmental engineering and alternative energy sources.

Students will know how passive solar heating can be used as energy in homes.

Students will know about the role played by an engineer in passive solar design.

Students will know the different types of heat transfer.

Students will be skilled at using research skills to explore the areas of alternative energy and heat transfer.

Students will be skilled at building models with precision to the given specifications.

Students will be skilled at using mathematical and measurement skills to collect data relevant to the design challenge.

Students will be skilled at expressing their findings orally and through the creation of self designed wind blades.

Students will be skilled at calculating the optimum angle for placement of the solar panel when using solar vehicles.

Students will be skilled at determining the relationship between lumens measured and solar vehicle speed.

Learning Plan

Investigating Natural vs Artificial Light: Students will experiment to see how the light source affects the operation of the solar vehicle. Students will work with a partner to first complete a worksheet investigating different types of natural light and artificial light. Students can complete an optional opening assignment where they use only materials from nature to build a small structure on a paper plate that will protect solar beads from changing color when they go outdoors. Students will first test their solar vehicles using an artificial light source, record data, then test using the sun, and record data. Students will complete a conclusion statement stating how the light force affected the function of the vehicle.

Determining Optimum Angle: Students will determine the optimum angle for placing the solar panel on the vehicle. Using a protractor, students will measure the angle their solar panel is placed. Students will secure the solar panel in place temporarily with a rubber band. Students will record the speed with a stopwatch. Students will then change the angle two more times, collect the data, and create a graph detailing the results. Students will complete their digital portfolio on the results and share these with the class.

Investigating Intensity vs Velocity: Students design and conduct an experiment to determine the relationship between light's intensity and the solar vehicle's velocity. Students will work on how to measure light intensity and velocity. Students will then work in small groups to develop their own procedure to complete this challenge, including taking photos, recording data, assigning roles for each partner, and completing a digital portfolio and reflection.

Measuring Wind Speed: Students will use an anemometer to measure wind speed at various distances and graph the results. Students will measure distances from the fan to the anemometer, anemometer speed readings, and create a graph detailing their results. Results will be shared with the class. Students will have a focus on how to accurately read an anemometer during this assignment.

Wind Blade Design: Students will design and construct their own turbine blade shapes that produce the greatest amount of voltage. Students will use a multimeter to determine the amount of voltage produced when using their blade design. Three design options will first be drawn on paper. The top design will be cut out from the paper and traced onto card stock. Groups can decide to have between 3-5 turbine blades. Students will use a 9v battery, red and black leads, and a multimeter to set up their design and test it. Students will record their data and create their own graph to show their findings. Results will be shared with the class and students will complete their digital portfolio, including data, graph, reflection, and conclusion statement.

Designing a Shelter for Solar Beads: Students will design and construct a shelter that protects solar UV beads from sunlight. Students will explore concepts related to light, UV radiation, and engineering design while working collaboratively to plan, build, test, and improve their structures. After testing their designs outdoors or under a UV light source, students will analyze the effectiveness of their shelters, collect data, and make improvements based on their results.

Assessment Type

Formative:

Do Nows

Google Forms

Google Slides

Investigating Natural vs Artificial Light assignment

Summative:

Wind Blade Design assignment

Measuring Wind Speed assignment

Benchmark:

Determining Optimum Angle assignment

Exit tickets

Google Slides

Alternative:

Checklists

Verbal discussions

Materials

Chromebooks

SmartBoard

YouTube

Pen/pencil

Ruler

Fishing wire

Completed Eco-Wind Gen II

Completed Ray Catcher Solar Vehicle

Solar beads

Anemometer

Electric fan

Hair blow dryer

Masking tape

Colored pencils or markers

Graph paper

Red and black test leads

Glue

Protractor

Scissors

Card stock

Balsa sticks

Wax paper

Light meter

Stopwatch

Tape measure

Bands

Integrated Accommodation and Modifications, Spec Ed Students, ELL, At-Risk, G&T, 504's

See attached document:

https://docs.google.com/spreadsheets/d/1pzkODxxGOSxESwthnE0jQW8hVfMaZ9ygEBg5QsKBcDA/edit?usp=sharing