2023 U10 iSTEM 3 - Intro to Environmental Engineering

Content Area: **CTE**
Course(s): **iSTEM**
Time Period: **February**
Length: **10 - 12 weeks**
Status: **Published**

Unit Overview:

In this unit, students explore the various roles of environmental engineers, including: industrial disasters, environmental cleanup, renewable resources, and the energy that can be harnessed from those resources. In particular, students will explore the BP oil spill, processes for oil spill removal, and study the impacts that industrial disasters have on the environment. The unit will progress from environmental impacts of non-renewable resources to the research, exploration, and analyzation of non-renewable and renewable resources. Investigating the different resources will allow students to formulate their own opinions of renewable energy based on facts and assess the feasibility of wind and solar energy. The unit will culminate with the fabrication and testing of student produced wind turbines with the careful considerations of what characteristics are needed when trying to produce the most efficient and effective turbine blades.

Essential Questions:

- How can industrial disasters be mitigated?
- What processes are used for the environmental clean up of industrial disasters?
- Why was the BP Oil Spill so significant?
- What are renewable and nonrenewable resources?
- How can humans use renewable resources to produce renewable energy?
- How do environmental problems and solutions change over time?
- What are the uses of solar energy in power generation. What are the effects of the use of solar energy in power generation?
- What are the uses of hydroelectricity in power generation & the effects of the use of hydroelectricity in power generation?
- What are the uses of wind energy in power generation. What are the effects of the use of wind energy in power generation?
- How does solar energy convert into electricity used in your house?
- How does wind energy convert into electricity used in your house?

Enduring Understandings:

- Identify differences between nonrenewable and renewable energy sources.
- Describe trends in energy consumption.
- Identify types of fuels and their uses
- Identify where natural energy resources occur.
- Describe the use and methods of fossil fuels in power generation.
- Describe the effects of fossil fuels on the environment.

- Describe the use of solar energy in power generation.
- Describe the effects of the use of solar energy in power generation on the environment.
- Describe the use of hydroelectricity in power generation.
- Describe the effects of the use of hydroelectricity in power generation on the environment
- Describe the use of wind energy in power generation.
- Describe the effects of the use of wind energy in power generation on the environment.
- Identify, Classify, and Critique the importance and effectiveness of each factor that can be changed on a wind turbine blade

Lesson Titles:

- Presentation of Information: Renewable vs Non Renewable Resources and Energy, Video on BP Oil Spill, Documents and link of processes used to clean up industrial disasters

- Student Presentations on types of renewable Energy

- Mini - Project: Oil Removal

- How energy uses effect Climate Change

- - Mini - Project: Solar Panel Assembly and Measurements

- Factors of Wind Turbine Assembly

- Design Challenge: Non Geared and Geared Turbine Blade Testing

- Project Presentations

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Direct Instruction: Daily Overviews (Promethean Board, Chromebooks, White Board)
- Direct Instruction: Presentations - Presentations of Information (google slides)
- Instruction: Videos / Links to documents for Industrial Disasters
- Independent Work: Energy Uses and Climate Change
- Indirect Instruction: Reflective Discussion, Evaluation of Data and Technical Writing - ENB Write Ups, Self Evaluations, Presentation of Projects
- Experiential: Project - Non Geared and Geared Turbine Blade Testing
- Experiential:- Mini - Project: Oil Spill Removal
- Experiential:- Mini - Project: Solar Panel Assembly
- Cooperative: Partner classwork, short projects, projects and ENB entries

Summative Assessment:

- Mini - Project: Oil Spill Removal
- Mini - Project: Solar Panel Assembly
- Project: Non Geared and Geared Turbine Blade Testing
- Quiz: Oil Spill Removal ENB Write UP
- Quiz: Renewable Energy Presentation to Class
- Quiz: Solar Panel Assembly ENB Write UP

Formative Assessment:

- Anticipatory Set - Overview of items for the day, future activities of the unit, and/or review of previous information from the unit
- Classroom / Student Observation - check in on student work during in-class activities / projects
- Closure of Projects - students provide results of their projects, self-evaluate projects for possible improvements that could be made, and evaluate instruction that could be improved
- Closure of Units - students complete a design project that pertains to the unit at hand as well as prior units
- Conferences between the instructor and student at various points in the semester.
- ENB (engineering notebooks) - reviewed periodically during the school year
- In-class activities where students informally present their results.
- Presentation Sample Slides - Students participate in classroom discussion on topic that is being introduced and reviewed
- Q & A session - Student led question and answer session at the start of class for project information as needed
- Question and answer sessions, formal, planned and informal, spontaneous.
- Warm-Up - review information from current topic or previous topics, preview time for current activity, and/or opportunity for clarity on the previous day's work

Benchmark Assessments

Skills-based assessment

Reading response

Writing prompt

Lab practical

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Standards/Indicators/Student Learning Objectives (SLOs):

9-12.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.
9-12.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.
9-12.HS-ETS1-1.1.1	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
9-12.HS-ETS1-3.6	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.
9-12.HS-ETS1-3.6.1	Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-ETS1-2.6.1	Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-ETS1-1.ETS1.A.2	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.

Career Readiness, Life Literacies, & Key Skills:

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections:

LA.SL.11-12.1.D	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.
LA.SL.11-12.2	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.SL.11-12.6	Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.
SCI.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Technology Materials and Standards

- SmartBoard Presentations
- Chromebooks, Google Drive, Google Applications
- MS Office Software as needed
- Smartphones
- Construction Hand Tools and Safety Equipment

TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.C.CS3	Develop cultural understanding and global awareness by engaging with learners of other cultures.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.

Computer Science and Design Thinking Standards

CS.K-12.2.a	Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.
CS.K-12.2.c	Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

CS.K-12.4.b	Evaluate existing technological functionalities and incorporate them into new designs.
CS.K-12.4.c	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

Equity Considerations

Asian American Pacific Islander Mandate

Topic: Activities that emphasize the impact of Asian American and Pacific Islanders on STEM

Materials Used: https://www.idtech.com/blog/aapi-heritage-month-stem-activities

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

LGBTQ+ and Disabilities

Topic: What topics can have an impact on individuals in LGBTQ

Materials Used: https://prideinstem.org/lgbtstemday/

Topic: What topics can have an impact on individuals with Disabilities

Materials Used: https://alexandertutoring.com/supporting-stem-education-students-disabilities/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Climate Change

Topics: Activities to help students understand Climate Change

Materials Used: https://www.weareteachers.com/climate-change-activities/

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Modifications

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

ELL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student

- Read test passages aloud (for comprehension assessment)
- Vary test formats

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions
- Review of directions
- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in

the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Resources & Materials:

- Project Lead the Way, Introduction to Engineering Design Information
- Walker, Exploring Drafting, II: Goodhart-Wilcox, 1996
- Gradwell & Wekch. Technology, Engineering Our World, IL: Goodhart-Wilcox, 2012