Grade 5 STEM Unit 2: The Engineering Process and Simple Machines

Content Area: **STEM**
Course(s): **STEM Grade 5**
Time Period: **MP1**
Length: **8 days**
Status: **Published**

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3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science and Engineering Practices

Asking Questions and Defining Problems

Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Planning and Carrying Out Investigations

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Constructing Explanations and Designing Solutions

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5- ETS1-1)

ETS1.B: Developing Possible Solutions

Research on a problem, such as climate change, should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) □

At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) □

Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Crosscutting Concepts

Influence of Engineering, Technology, and Science on Society and the Natural World

People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1) □

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Rationale and Transfer Goals

This unit combines the principles of Simple Machines and Engineering Design to engage students in hands-on problem-solving and creative thinking. By exploring the concepts of simple machines and applying engineering design processes to solve real-world challenges, students will develop critical skills that are essential for understanding the world around them.

Enduring Understandings

Simple machines make work easier by changing the force or distance needed to perform a task.

Engineering design involves identifying problems, brainstorming solutions, building prototypes, and testing and improving designs.

Essential Questions

How do simple machines affect force and motion in everyday tasks?

How can the engineering design process be used to create solutions for practical problems?

What is the relationship between simple machines and engineering design?

Content - What will students know?

- Types and functions of simple machines
- Examples of simple and complex machines
- The Engineering Design Process

Skills - What will students be able to do?

- Identify and categorize simple machines
- Identify advantages to utilizing simple machines
- Apply Engineering Design Principles
- Build and test prototypes

Activities - How will we teach the content and skills?

- Simple machines google slides Class discussion
- Marshmallow Catapults
- Bridge Building Miniatures
- Paper Circuits
- Design a Parade Float

Evidence/Assessments - How will we know what students have learned?

- Question and answer worksheet accompanying google slides Pre/post quiz
- Final Builds for projects
- Daily Formative Assessments

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
Engineering design process		Reflect on the similarities and differences between the engineering design process applied to simple machines and the more complex challenges in this unit.

Key Resources

- www.teachengineering.org
- www.awea.org
- www.energyquest.ca.gov/
- www.eia.gov/kids/
- www.nrel.gov

21st Century Life and Careers

9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.

Career Readiness, Life Literacies, & Key Skills

9.4.5.CI.3	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CI.4	Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.2	Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

Interdisciplinary Connections/Companion Standards

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RI.5.1 Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different perspectives of a topic. (3-5-ETS1-1), (3-5-ETS1-3)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital

sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1), (3-5-ETS1-3)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1), (3-5-ETS1-3)

NJSLS Mathematics

MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

MP.4 Model with mathematics. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

MP.5 Use appropriate tools strategically. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1), (3-5-ETS1-2)