Unit 1 Project -Rube Goldberg Machine: Wind Powered Vehicle (adapted from MESA)

Name: ______________________________ Due Date : September 19, 2025 **Parent Acknowledgement Form**

Standards

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.

Objective

In groups of 2 or 3, students will design and construct a complex machine that integrates three to six sequential and dependent actions utilizing designated categories of energy and simple machines. The ultimate goal is to propel a wind-powered vehicle (bus or car) the farthest distance using the least amount of time.

TO EARN A GRADE, your project must include the following components, in addition to timeline checkpoints:

- Design and create a Rube Goldberg machine that propels a vehicle.
- Complete an engineering notebook.
- Present your project to class using *Flip* or Youtube.

Machine rules

1. For the complex machine, all materials are legal with the exception of hazardous materials or unsafe energy.
2. For the wind-powered vehicle, all materials are legal with the exception of additional stored energy; kits are NOT allowed.
3. The complex machine must be initiated by a single operation of pulling a string provided by the team; the string or cord may be any type, thickness, material, etc.
4. No human or other assistance, interference, aid, etc. may be used for the entire operation of the complex machine (i.e., the machine must do all the work) AFTER the initiation of pulling the string.
5. All parts of the complex machine (i.e., the MESA Machine) must fit into a 75 cm by 75 cm by 75 cm cube (i.e., the Machine Zone).
6. The complex machine must incorporate between three (3) to six (6) actions that are sequential and dependent upon the previous action. Each of the three to six actions MUST only use one of the following listed
7. categories of energy/simple machines:
   i. Gravity (e.g., free fall, ramps, etc.)
   ii. Springs or rubber bands (e.g., tension springs, bungee cords, torsional springs, mousetrap, etc.)
   iii. Levers or pulleys (e.g., seesaw, bottle opener, tongs, fi xed pulley, movable pulley, compound pulley, etc.)
   iv. Electronics (e.g., DC motors, circuit boards, generators, sensors, etc.)
8. Three (3) different categories of energy/simple machines listed above MUST be used.
9. All parts of the wind-powered vehicle (e.g., wheels, axles, frame, sail, any moving parts) must fit into the 35 cm by 35 cm Vehicle Start Zone, including all lengths and widths of the vehicle; no restriction on the height.

Checkpoints

You will need to record and submit your progress on Schoology regularly. This is a part of your grade. Show your teacher what you have been working on. It is recommended that you keep a log and take pictures of your work. Simply telling the teacher what you have done does not count. You need to provide evidence.

Here are the checkpoint dates and suggested completed activities:

August 22, Friday- Sign Parent Acknowledgement Form
August 28, Thursday - Preliminary Blueprint. Teacher approval required before building.
September 5, Friday- Building and testing.
September 12, Friday- Submit revision/additions. Continue building, testing and prepare for presentation
September 19, Friday- Submit project, engineering log and video presentation.

Engineering Log

The purpose of the Engineering Lab Book is for students to better understand the process an engineer goes through in the creation of a project. This project is not designed to be completed in a single class period or day, but to be the result of thoughtful research, planning, analysis and evaluation. Keeping a lab book throughout the design process will help to keep one on track, using a logical progression of planning, in order to develop their project efficiently. Use this Sample Engineering Lab report and Engineering Lab Book Blank Template.

Presentation

Your presentation should be clear, engaging, and well-organized. You will need to effectively communicate your design process, the challenges you faced, and the solutions you developed. You can present your engineering project through Google Drive , YouTube (private settings), or any accessible cloud storage. Be sure to clearly demonstrate how your project fulfills the necessary criteria.

Tips

Students:

- If the project seems too difficult or time consuming, think of new ways to make a step work which will require less energy or time. Sometimes the design is flawed or too complicated.
- Set goals and timelines. Complete one goal before moving onto the next goal.
- Look for things that are already built and can be modified for your use.
- Use free/cheap items - cardboard, tape, old toys, etc. are great resources.
- Be aware of the height of your project. As you add height, it becomes more unstable.
- Sometimes working backwards helps.
- If a specific step does not work from your original plans, you may need to re-design that step. Be sure to get approval for all new additions to your project at the revision checkpoint.
- Communicate your needs and responsibilities with your family.
- Things to consider:
    - Gravity (e.g. free fall, ramps, etc.)
    - Springs or rubber bands (e.g. tension springs, bungee cords, torsional springs, mousetrap, etc.)
    - Levers or pulleys (e.g. seesaw, bottle opener, tongs, fixed pulley, movable pulley, compound pulley, etc.)

- Electronics (e.g. DC motors, circuit boards, generators, sensors, etc.)
- Pressurized fluids (such as air or water)

Parents:

- There may be frustration - encouragement and support are key!
- Please supervise your child, especially if using tools.
- This is a student-based project. Please guide them rather than doing it for them.
- Help plan a schedule so your child does not wait until the last minute to complete the project.
- This project will not be graded on aesthetics, but rather the creative functionality of the contraption.
- Keep cost to a minimum!

Resources

Sample Project 1
Sample Project 2
MESA MACHINE Course 2023-24
MESA Resources

Rubric

	Exemplary 4	**Proficient 3**	**Developing 2**	**Needs Improvement 1**
Engineering Design & Creativity (16 pts)	Design demonstrates innovative thinking, is highly functional, and effectively solves the problem. Clear and thoughtful consideration of multiple solutions.	Design is functional and addresses the problem effectively. Some evidence of creative problem-solving.	Design addresses the problem but lacks creativity or a detailed approach. Some functionality is evident.	Design is incomplete or does not effectively solve the problem. Lacks creativity and detail.
Engineering Log & Documentation (12 pts)	Log is thorough, organized, and clearly documents every step of the design process. Includes sketches, notes, data, and reflections.	Log is well-organized and covers most steps of the design process with relevant documentation and reflections.	Log is somewhat organized but lacks detail. Some steps in the design process are missing or not well-documented.	Log is disorganized or incomplete, with little to no documentation of the design process.
Presentation & Communication (12 pts)	Presentation is clear, engaging, and well-organized. Students effectively communicate the design process, challenges, and solutions.	Presentation is clear and organized. Students communicate the design process and outcomes effectively.	Presentation is somewhat clear but may lack organization or detail. Communication of the design process and outcomes is	Presentation is unclear or disorganized. Students struggle to communicate the design process and outcomes effectively.

			adequate.	
Adherence to Design Specifications & Requirements (8 pts)	Project fully meets or exceeds all specified criteria and requirements. All design constraints and specifications are carefully followed.	Project meets most specified criteria and requirements, with minor deviations from the design constraints.	Project meets some of the specified criteria and requirements, with noticeable deviations from the design constraints.	Project does not meet the specified criteria and requirements, with significant deviations from the design constraints.