



Project Compound Design Brief

Background

Mechanical systems often require a combination of mechanisms to complete a given task. Any time two or more machines are combined, the result is a compound machine. If many mechanisms are combined, the machine may even be referred to as a complex machine. Compound machines can range in complexity from a crane or automobile to a simple manual can opener. A bicycle is an example of a compound machine. The pedals, brakes, handle bars, and sprocket systems are just some of the mechanisms on most bicycles



There is a group of individuals that are trying to live life using compound machines to complete everything, even the simplest tasks. They live in a place called the Compound, location not to be disclosed. They are in need of more machines. No one must know about them or their goal; it could mean disaster for humanity.

Target Consumer:

Residents of The Compound

Design Statement

With a partner, design and build a compound machine to accomplish a specified task.

Design Constraints

1. The applied effort force may only be provided by a single human input.
2. The final design must include a minimum of three **different** types of mechanisms including any of the simple machines: a gear system; a pulley and belt system; and / or a sprocket and chain system.
3. Your compound machine must be made of various VEX[®] components. You may use rubber bands as part of your pulley belt systems and string for any pulley systems.
4. Overall Mechanical Advantage cannot be equal to 1.

Procedure

1. Define the Problem:
 - a. Remember what your guest speaker spoke to you about and summarize it.
 - b. Determine the task in detail, including all required operations and time constraints.
 2. Generate Concepts:
 - a. Brainstorm ideas for accomplishing the assigned task, and record at least two ideas in your engineering notebook.
 - b. Use a decision matrix to determine which approach you will use.
 - c. In your engineering notebook sketch and annotate a preliminary design solution. For each mechanism state whether it will have a mechanical advantage greater than, less than, or equal to 1.
 - d. Have an instructor sign off on your brainstorm ideas and your preliminary sketch.
 3. Construct Prototype:
 - a. Build, test, and modify your compound machine design.
 - b. In your engineering notebook take a photograph of the final design and label each of the mechanisms in the photograph.
 4. Evaluate the Design:
 - a. Use the provided data tables to document and illustrate the mechanical advantage and drive ratios of the individual mechanisms utilized within your final compound machine solution. Show work and units throughout. Place the data tables in your engineering notebook.
 - b. In your engineering notebook calculate the overall/total gear/speed of the system. You may use the data table provided in class.
 - c. In your engineering notebook calculate the overall/total Ideal Mechanical Advantage of the system. You may use the data table provided in class.
 - d. In your engineering notebook calculate the overall/total Actual Mechanical Advantage of the system. You may use the data table shown below.
 - e. In your engineering notebook calculate the overall/total efficiency of the system.
 5. Answer the following conclusion questions in your engineering notebook. Write the question and your response.
 - a. For which mechanism was it the easiest to determine the mechanical advantage or drive ratio? Why was it the easiest?
 - b. For which mechanism was it the most difficult to determine the mechanical advantage or drive ratio? Why was it the most difficult?
 - c. Does your compound machine increase or decrease your input force? How do you know?
 - d. How efficient was your compound machine?
 - e. What modifications could you make to your compound machine to make it more mechanically efficient?
 6. Submit your engineering notebook and demonstrate your compound machine on
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