

## Team Members:

1. \_\_\_\_\_ 3. \_\_\_\_\_

2. \_\_\_\_\_ 4. \_\_\_\_\_

## Total Points

Workbook: ..... /23 pts

Challenge: ..... /30 pts

## Key Terms

Write the definitions of each key term in the space provided.

1. Simple Machine: \_\_\_\_\_

\_\_\_\_\_

2. Pulley: \_\_\_\_\_

\_\_\_\_\_

3. Mechanical Advantage: \_\_\_\_\_

\_\_\_\_\_

4. Force: \_\_\_\_\_

\_\_\_\_\_

5. Work: \_\_\_\_\_

\_\_\_\_\_

6. Effort: \_\_\_\_\_

\_\_\_\_\_

7. Load: \_\_\_\_\_

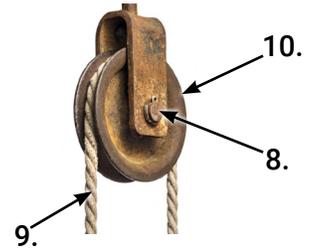
\_\_\_\_\_



## Elements of a Pulley

There are three basic elements in a pulley. Identify the correct element in the spaces provided.

8. \_\_\_\_\_ 9. \_\_\_\_\_ 10. \_\_\_\_\_



## Purpose of a Pulley

A pulley is used for two different purposes. Fill in each purpose in the blank below.

11. Fixed Pulley System: \_\_\_\_\_

12. Movable Pulley System: \_\_\_\_\_

## Real World Application

Research some real world applications of pulleys. Write two examples, not found in the curriculum packet, in the spaces below.

13. \_\_\_\_\_

14. \_\_\_\_\_

## Build and Modify

Place a check in the boxes below as the team completes each step.

15.  Build Pulley System.

16.  Test/observe Fixed Pulley System.

17.  Test/observe Movable Pulley System.



## Understanding Mechanical Advantage

Fill in the blanks in the statements below.

18. Mechanical Advantage exists when the \_\_\_\_\_ force of a machine is \_\_\_\_\_ than the \_\_\_\_\_ force that was applied to it.

19. For a machine to create mechanical advantage, it must trade increased time or \_\_\_\_\_ for reduced effort.

## Calculating Mechanical Advantage

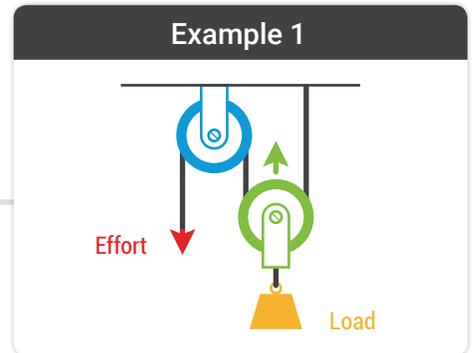
Use the formulas for calculating mechanical advantage to solve the problems below.

20. In Example 1, if the **effort** travels 40cm and the **load** travels 20cm, what is the mechanical advantage?

**Mechanical Advantage:** \_\_\_\_\_

**All Pulley Systems**

$$\frac{\text{Distance of effort}}{\text{Distance of load}} = \text{Mechanical Advantage}$$

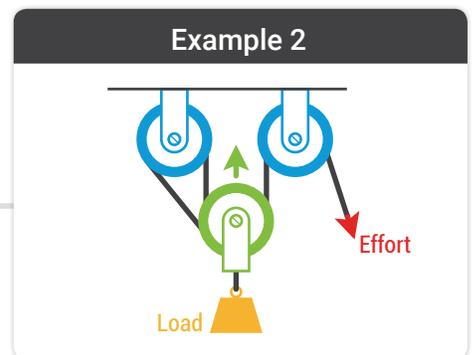


21. Determine the mechanical advantage of the pulley system in example 2.

**Mechanical Advantage:** \_\_\_\_\_

**Movable Pulley Systems**

$$\text{\# of strings connected to movable pulley} = \text{Mechanical Advantage}$$



## Modify Pulley System

Place a check in the box below as the team completes each step.

22.  Modify Movable Pulley System from 2:1 to 3:1 Mechanical Advantage.

23.  Teacher confirms modification is correct.



## Design & Engineering Challenge

Follow each step in the design & engineering process to develop a solution to the challenge. Place a check in the box as each step is completed. Fill in the blanks when necessary.

### 1. Identify The Challenge

- Challenge: \_\_\_\_\_
- Sub-Challenge: \_\_\_\_\_
- Sub-Challenge: \_\_\_\_\_
- Sub-Challenge: \_\_\_\_\_
- Sub-Challenge: \_\_\_\_\_
- Review specifications

### 2. Brainstorm Ideas & Solutions

- Discuss design ideas.
- Consider building components and cost.

### 3. Build A Prototype

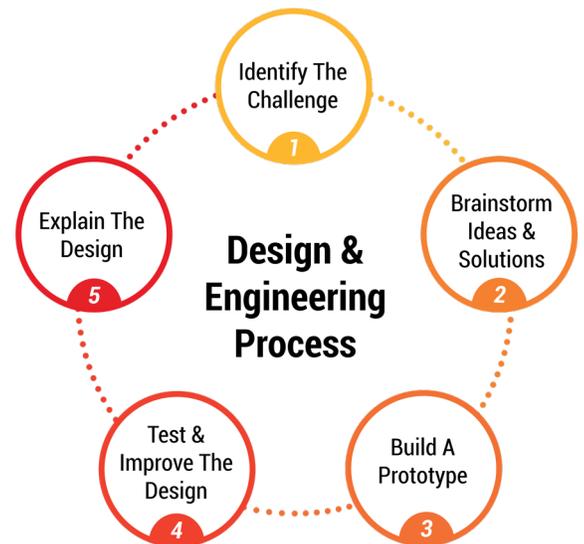
- Build a working prototype of the design.

### 4. Test & Improve The Design

- Test & improve the design for performance and consistency.
- New challenge discovered: \_\_\_\_\_
- Review grading rubric and design specifications.
- Consider ways to reduce cost.

### 5. Explain The Design

- Prepare to demonstrate and present the design to others.
- Review project grading rubric.
- Explain any unique design features that were included.
- Describe at least one new problem/challenge discovered during Step 4 (Test and Improve The Design) and how the team redesigned a new solution.





## Challenge Evaluation

When teams have completed the design & engineering challenge, it should be presented to the teacher and classmates for evaluation. Teams will be graded on the following criteria:

-  **Specifications:** Does the design meet all specifications as stated in the design brief?
-  **Performance:** How well does the design work? Does it function consistently?
-  **Team Collaboration:** How well did the team work together? Can each student describe how they contributed?
-  **Design Quality/Aesthetics:** Is the design of high quality? Is it structurally strong, attractive, and well proportioned?
-  **Material Cost:** What was the total cost of the design? Was the team able to stay on or under budget?
-  **Presentation:** How well did the team communicate all aspects of the design to others?

Grading Rubric	Advanced 5 Points	Proficient 4 Points	Partially Proficient 3 Points	Not Proficient 0 Points
<b>Specifications</b>	<input type="checkbox"/> Meets all specifications	<input type="checkbox"/> Meets most specifications	<input type="checkbox"/> Meets some specifications	<input type="checkbox"/> Does not meet specifications
<b>Performance</b>	<input type="checkbox"/> Design performs consistently well	<input type="checkbox"/> Design performs well often	<input type="checkbox"/> Design is partially functional	<input type="checkbox"/> Design does not work
<b>Team Collaboration</b>	<input type="checkbox"/> Every member of team contributed	<input type="checkbox"/> Most members of team contributed	<input type="checkbox"/> Some members of team contributed	<input type="checkbox"/> Team did not work together
<b>Design Quality/ Aesthetics</b>	<input type="checkbox"/> Great design/ aesthetics	<input type="checkbox"/> Good design/ aesthetics	<input type="checkbox"/> Average design/ aesthetics	<input type="checkbox"/> Poor design/ aesthetics
<b>Material Cost</b>	<input type="checkbox"/> On Budget (\$120 or Less)	<input type="checkbox"/> Slightly Over Budget (\$120-130)	<input type="checkbox"/> Over Budget (\$130-140)	<input type="checkbox"/> Significantly Over Budget (\$141+)
<b>Presentation</b>	<input type="checkbox"/> Great presentation/ well explained	<input type="checkbox"/> Good presentation/ well explained	<input type="checkbox"/> Poor presentation/ explanation	<input type="checkbox"/> No presentation/ explanation
<b>Points</b>	.....	.....	.....	.....
<b>Total Points</b>				..... /30