Team Members:

1. _____ 3. _____

2. _____ 4. _____

Total Points	
Workbook:	/25 pts
Challenge:	/30 pts

Key Terms

Match the key terms that are listed in the word bank with the correct definition. Write the correct letter in the space provided.

1. _____ The amount a machine multiplies force.

2. _____ Using a force to move an object a distance.

3. _____ A simple machine consisting of a rigid beam that pivots on a fulcrum. It is used to redirect motion, increase output speed, or create mechanical advantage.

4. _____ A force applied to a machine to do work.

5. _____ The object or weight being moved or lifted.

6. _____ A push or a pull.

7. _____ The point or support on which a lever pivots.

8. _____ A device that transmits or modifies force or motion.

9. _____ The mechanical advantage gained by using a lever.

Key Terms

A. Simple Machine

B. Force

C. Lever

D. Work

E. Mechanical Advantage

F. Leverage

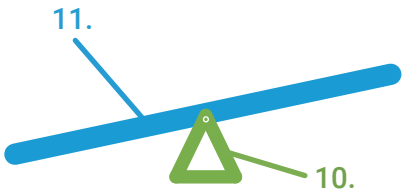
G. Effort

H. Load

I. Fulcrum

Elements of a Lever

Identify the correct element in the spaces provided.



10. _____ **11.** _____

Purposes of a Lever

List the three purposes of a lever in the spaces provided.

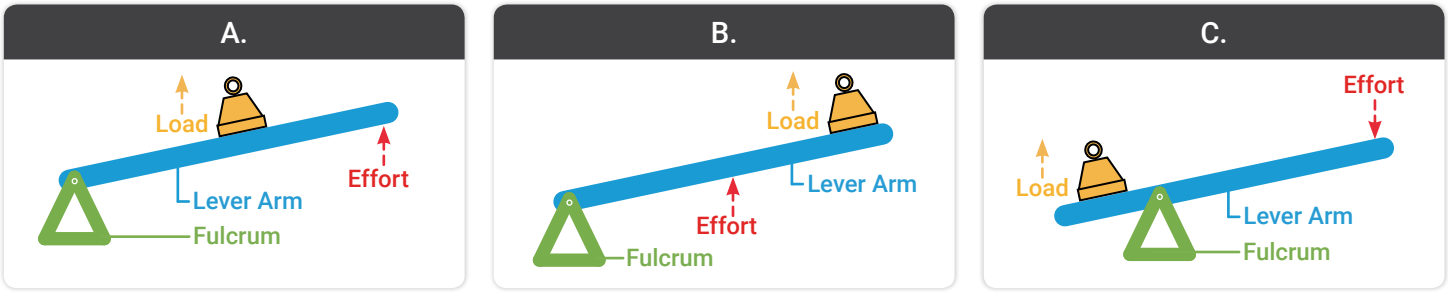
12. _____

13. _____

14. _____

Types of Levers

Review the figures below, then write the correct type of lever in the spaces provided.



15. _____ **16.** _____ **17.** _____

Build and Modify

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

18. ☐ Build, test, and modify a First Class Lever

19. ☐ Build, test, and modify a Second Class Lever

20. ☐ Build, test, and modify a Third Class Lever

Understanding Mechanical Advantage

Fill in the blanks to complete the statements below.

21. Mechanical Advantage exists when the _____ force of a machine is _____ than the _____ force that was applied to it.

22. For a machine to create mechanical advantage, it must trade increased time or _____ for reduced effort.

Calculating Mechanical Advantage in a Lever

Use the formulas to solve the problems below.

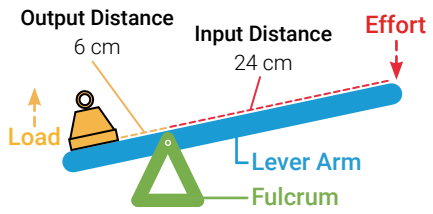
23. Determine the mechanical advantage of the lever in Example 1.

Mechanical Advantage: _____

First Class Lever

$$\text{Mechanical Advantage} = \frac{\text{Input distance (effort to fulcrum)}}{\text{Output distance (load to fulcrum)}}$$

Example 1 - First Class Lever



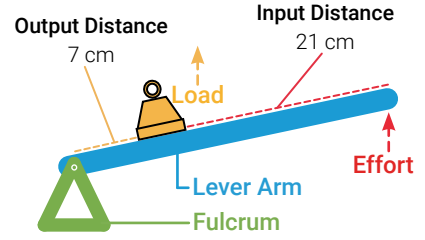
24. Determine the mechanical advantage of the lever in Example 2.

Mechanical Advantage: _____

Second Class Lever

$$\text{Mechanical Advantage} = \frac{\text{Input distance (effort to load)}}{\text{Output distance (load to fulcrum)}}$$

Example 2 - Second Class Lever



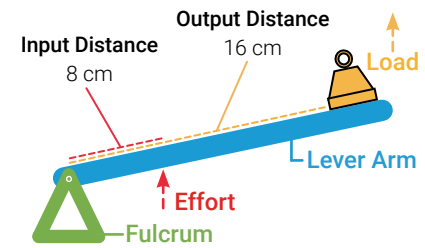
25. Determine the mechanical advantage of the lever in Example 3.

Mechanical Advantage: _____

Third Class Lever

$$\text{Mechanical Advantage} = \frac{\text{Input distance (effort to fulcrum)}}{\text{Output distance (load to fulcrum)}}$$

Example 3 - Third Class Lever

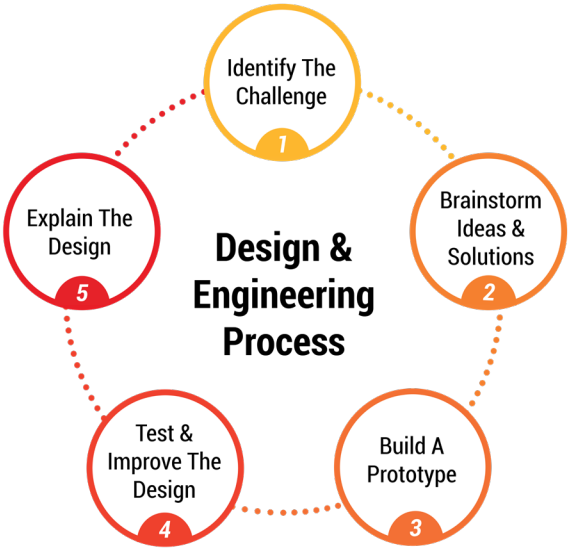


Design & Engineering Challenge

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: _____
- ☐ 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 & 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 descibe 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
Specifications	☐ Meets all specifications	☐ Meets most specifications	☐ Meets some specifications	☐ Does not meet specifications
Performance	☐ Design performs consistently well	☐ Design performs well often	☐ Design is partially functional	☐ Design does not work
Team Collaboration	☐ Every member of team contributed	☐ Most members of team contributed	☐ Some members of team contributed	☐ Team did not work together
Design Quality/ Aesthetics	☐ Great design/ aesthetics	☐ Good design/ aesthetics	☐ Average design/ aesthetics	☐ Poor design/ aesthetics
Material Cost	☐ On Budget ($140 or Less)	☐ Slightly Over Budget ($141-145)	☐ Over Budget ($146-155)	☐ Significantly Over Budget ($156+)
Presentation	☐ Great presentation/ well explained	☐ Good presentation/ well explained	☐ Poor presentation/ explanation	☐ No presentation/ explanation
Points	……	……	……	……
Total Points				…… /30