

## Team Members:

1. \_\_\_\_\_ 3. \_\_\_\_\_  
2. \_\_\_\_\_ 4. \_\_\_\_\_

## Total Points

Workbook: ..... /30 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.

- \_\_\_\_\_ The distance around a circle.
- \_\_\_\_\_ Using a force to move an object a distance.
- \_\_\_\_\_ An inclined plane wrapped around a cylinder that converts rotary motion into linear motion.
- \_\_\_\_\_ The distance from the center of a circle to the outside edge.
- \_\_\_\_\_ The object or weight being moved or lifted.
- \_\_\_\_\_ A push or a pull.
- \_\_\_\_\_ An irrational, infinite number (3.14...), that represent the ratio of a circle's circumference to its diameter.
- \_\_\_\_\_ The resistance that one surface or object encounters while in contact with and moving across another.
- \_\_\_\_\_ The distance between threads on a screw.
- \_\_\_\_\_ A device that transmits or modifies force or motion.
- \_\_\_\_\_ The distance through the center of a circle from one side to another.
- \_\_\_\_\_ A force applied to a machine to do work.
- \_\_\_\_\_ The amount a machine multiplies force.
- \_\_\_\_\_ The raised ridge going around a screw.

## Key Terms

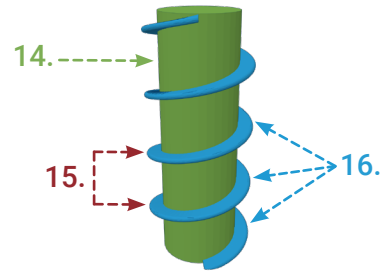
- A. Simple Machine
- B. Screw
- C. Screw Thread
- D. Screw Pitch
- E. Friction
- F. Mechanical Advantage
- G. Radius
- H. Diameter
- I. Circumference
- J. Pi
- K. Force
- L. Work
- M. Effort
- N. Load



## Elements of a Screw

Identify the correct element in the spaces provided.

14. \_\_\_\_\_ 15. \_\_\_\_\_ 16. \_\_\_\_\_



## Purposes of a Screw

List the two purposes of a screw in the spaces provided.

17. Purpose : \_\_\_\_\_

18. Purpose : \_\_\_\_\_

## Real World Application

Research some real world applications of the screw. In the space provided, write two examples not found in the curriculum packet.

19. \_\_\_\_\_

20. \_\_\_\_\_

## Build and Modify

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

21.  Build and test screw model.

22.  Modify and test screw model.



## Understanding Mechanical Advantage

Fill in the blanks in the statements below.

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

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

## Attributes of a Circle

Write the correct answer in the spaces provided below.

25. Calculate the diameter of the circle in example 1.

Diameter: \_\_\_\_\_

26. Use the formula to calculate the circumference of the circle in example 1.

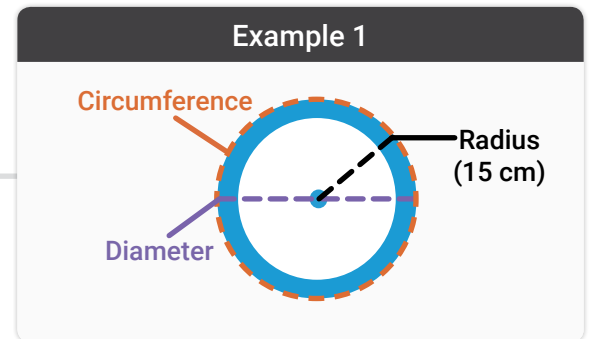
Circumference: \_\_\_\_\_

27. Calculate the radius of the circle in example 2.

Radius: \_\_\_\_\_

28. Use the formula to calculate the circumference of the circle in example 2.

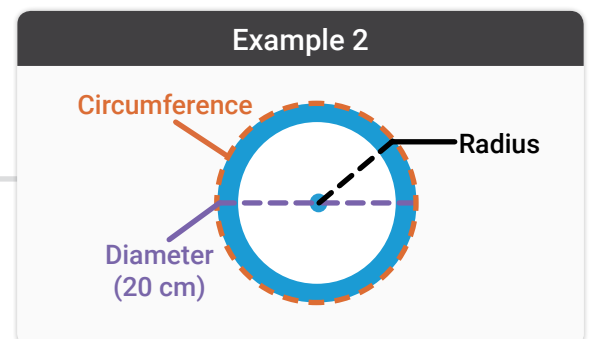
Circumference: \_\_\_\_\_



**Circumference Formula**

$$C = 2 \pi r$$

$r = \text{radius}$





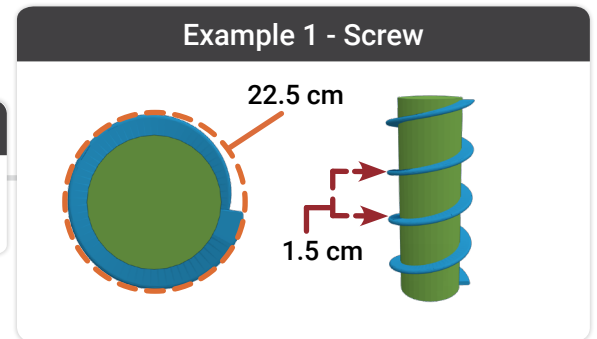
## Calculating Mechanical Advantage in a Screw

Use the formulas to solve the problems below.

29. Determine the mechanical advantage of the screw in Example 1.

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

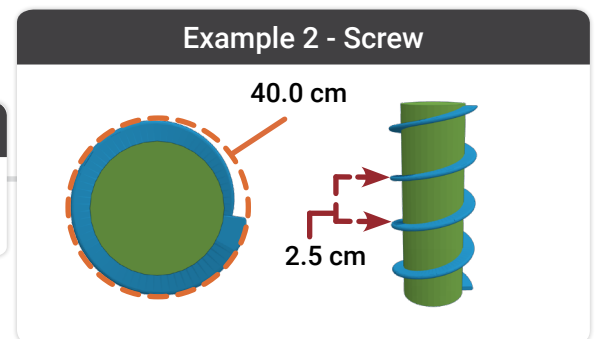
Formula	
Mechanical Advantage	= $\frac{\text{Circumference of Screw}}{\text{Pitch of Screw}}$



30. Determine the mechanical advantage of the screw in Example 2.

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

Formula	
Mechanical Advantage	= $\frac{\text{Circumference of Screw}}{\text{Pitch of Screw}}$





## 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

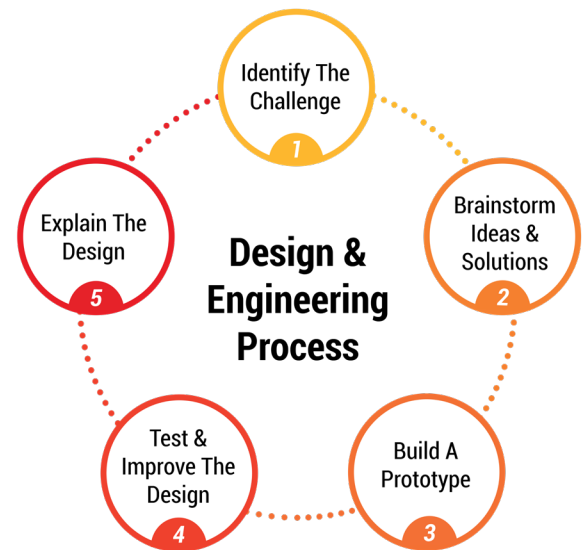
- Build a working prototype of the design.

### 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 (\$180 or Less)	<input type="checkbox"/> Slightly Over Budget (\$181-185)	<input type="checkbox"/> Over Budget (\$186-195)	<input type="checkbox"/> Significantly Over Budget (\$196+)
<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			