

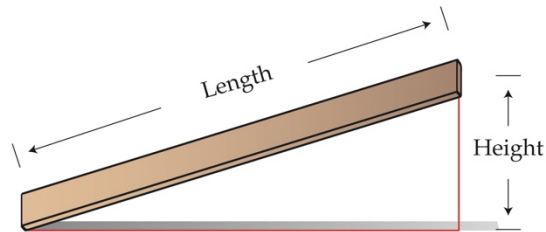
Name:

Date:

Class:

## Tools and Equipment, Part I Activity – Inclined Plane Worksheet

$$\text{Mechanical Advantage} = \frac{\text{Input Distance}}{\text{Output Distance}} = \frac{\text{Output Force}}{\text{Input Force}}$$



$$\text{Mechanical Advantage} = \frac{\text{Input Distance}}{\text{Output Distance}} = \frac{\text{Slope Length}}{\text{Height}}$$

### Instructions/Questions

#### A. Measure the length and height of Inclined Plane A (1<sup>st</sup> station):

Length: 30 (cm)

Height: 20 (cm)

1. What is the mechanical advantage based on these measurements? 1.5
2. What was the required force to raise the object?  
Without the inclined plane: (Output force) \_\_\_\_\_ (g)  
With the inclined plane: (Input force) \_\_\_\_\_ (g)
3. What is the mechanical advantage based on these measurements? \_\_\_\_\_

#### B. Measure the length and height of Inclined Plane B (2<sup>nd</sup> station):

Length: 60 (cm)

Height: 20 (cm)

1. What is the mechanical advantage based on these measurements? 3
2. What was the required force to raise the object?  
Without the inclined plane: (Output force) \_\_\_\_\_ (g)  
With the inclined plane: (Input force) \_\_\_\_\_ (g)
3. What is the mechanical advantage based on these measurements? \_\_\_\_\_

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**C. Measure the length and height of Inclined Plane C (3rd station):**

Length: 90 (cm)

Height: 20 (cm)

1. What is the mechanical advantage based on these measurements? 4.5
2. What was the required force to raise the object?

Without the inclined plane: (Output force) \_\_\_\_\_ (g)

With the inclined plane: (Input force) \_\_\_\_\_ (g)

3. What is the mechanical advantage based on these measurements? \_\_\_\_\_

**D. Measure the length and height of Inclined Plane D (4th station):**

Length: 120 (cm)

Height: 20 (cm)

1. What is the mechanical advantage based on these measurements? 6
2. What was the required force to raise the object?

Without the inclined plane: (Output force) \_\_\_\_\_ (g)

With the inclined plane: (Input force) \_\_\_\_\_ (g)

3. What is the mechanical advantage based on these measurements? \_\_\_\_\_

**Results**

1. Did you obtain different mechanical advantages for the different methods of measuring? If so, was the difference large?

Answers may vary.

2. Which inclined plane had the greatest mechanical advantage?

The longest inclined plane, Plane D, had the greatest mechanical advantage.

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### Conclusions

1. Does calculating mechanical advantage just with the dimensions of the inclined plane really work? That is, does the calculation describe what really happens? Write a short paragraph explaining your answer.

**Answers may vary.**

2. If you are the engineer designing a ramp for a construction site to move a wheelbarrow a height of 100 feet, which inclined plane would you use? Why?

**Answers may vary. Students may answer: the ramp with the greatest mechanical advantage. Whichever ramp they choose, their explanation of why they chose the ramps should be well thought out and explained.**

3. What are some possible sources of error in this experiment?

- **The needle on the spring scale was not steady and we had to estimate a number.**
- **Friction between the rotating axle and the cart increased the amount of force required to draw the cart up the plane**
- **Our measured distances may be off by a few millimeters, give or take.**