

# LAB 11, Inclined Plane & Pulley

Name \_\_\_\_\_ Period \_\_\_\_\_

Machines are used to make work more convenient by multiplying force at the expense of speed, or vice versa. A machine does not multiply work, however. The work output of a machine is never greater than the work input; thus the law of conservation of energy is not contradicted. In fact, the useful work output is always less than the work input because of the force of friction. The ratio of the useful work output to the work input is called the efficiency of the machine. Efficiency is often expressed as a percentage.

## OBJECTIVE:

In this experiment the efficiency of two machines will be measured. After completing this experiment, you should understand the principle of simple machines and be able to measure the efficiency of an inclined plane and a pulley system.

## A. Inclined plane.

### PROCEDURE:

Set up the inclined plane as shown in Figure 11-1. Let the angle be about  $30^\circ$ .

**CHOOSE A DESIGNATED DRIVER to guard the car!!! IT MUST NOT CRASH!**

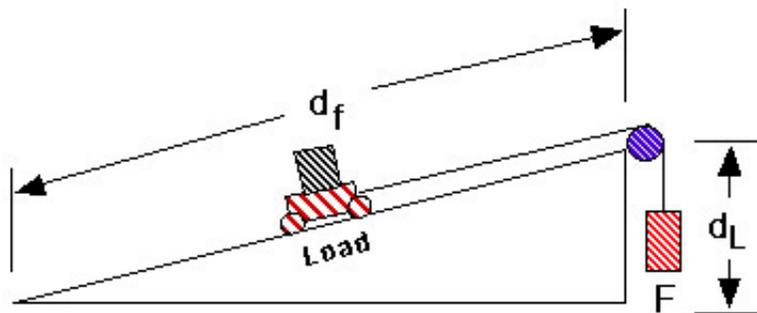


Fig 11-1

**NOTE:** The load is raised against gravity (straight up) and the force moves up the slope. See Fig. 11-1.

Mass the empty car, \_\_\_\_\_ g. Place a **100-g** mass in the car. Find the mass, **F**, that will balance the car when hung over the end of the board. Fill in the data table below.  $d_L$  is the distance moved by the load mass,  $d_f$  is the distance moved by the force mass.

**Data Table 1:**

Trial	Mass of Car grams	Mass in car grams	Total mass car + mass "the Load"	$d_L$ cm	$d_f$ cm	<b>F</b> grams
1	.	.	.	.	.	.
2	.	.	.	.	.	.
3	.	.	.	.	.	.

Make two more trials, each time increasing the mass in the car. Record all data.

**CALCULATIONS:**

**AMA = Load/Force, TMA =  $d_f/d_L$ . Efficiency = AMA /TMA X 100%**

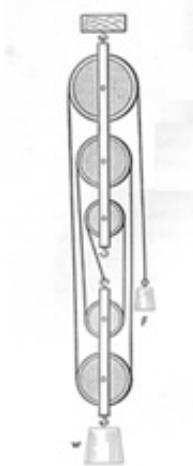
**A. Find the AMA, TMA, and Efficiency for the three trials above.**

**Trial 1:**

**Trial 2:**

**Trial 3:**

**B. Pulley.** Set up a six-pulley system using all three pulleys at the top and bottom.



Starting with a 1000g load, **W**, find the mass, **F**, that will balance the 1000-g mass.

***EACH STUDENT MUST FEEL THE FORCE. Let the Force be with Thee.***

**CALCULATIONS:**

**AMA = Load/Force, TMA =  $d_f/d_L$ . Efficiency = AMA /TMA X 100%**

**Find the AMA, TMA, and Efficiency of the pulley system.**

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**QUESTIONS:**

1. What does this experiment show about the feasibility of a perpetual motion machine? That is can we get something for nothing?

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2. What is the relationship, if any, between the efficiency of a pulley system and the number of pulleys it contains? Hint: Remember the *Demon Friction*.

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3. Why should *the force* be moving with constant velocity in each trial? Hint: We want *no change in velocity*.

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**CRITIQUE:**