Names of group members: Date: _____

1.)_____

2.)_____

3.)_____

4.)_____

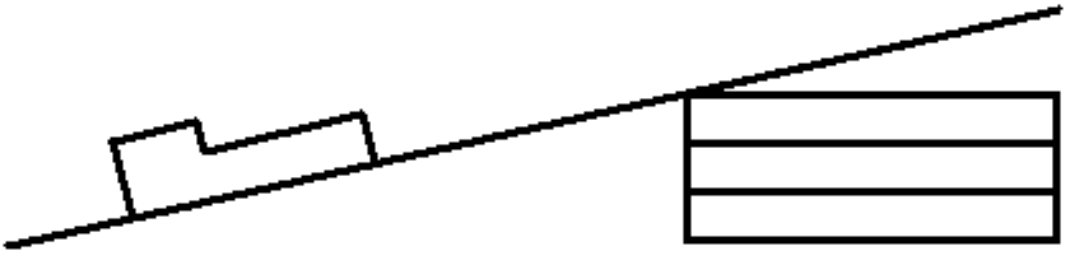
Inclined Plane Lab

Objective: To observe the relationship between work done by a machine and the amount of work put into a machine as well as compare the mechanical advantage of 5 inclined planes.

Materials: Inclined plane (ramp), momentum car, meter stick, spring scale one kilogram mass, 5 textbooks, graph paper, calculator

Procedures:

1. Collect materials and have them available at your work station.
2. Observe the following inclined plane picture with three books and label the force input, force output, distance input, and distance output.



3. Find the weight (force) of the car in newtons by hanging it from the correct spring scale and record.
4. Construct an inclined plane using one book, the momentum car, the ramp, and the 1 kg mass.
5. Record the following in Table 1 for each inclined plane system:
   A.) The length of the inclined plane.
   B.) The height of the inclined plane.
   C.) The force of the car added to the free weight.
   D.) The force needed to pull the car and free weight up the ramp.
6. Repeat steps 4 and 5 for inclined plane #2, #3, #4, and #5 by increasing the number of books only for each inclined plane system.

Data:

Weight of car: _____

# of books	Force car and free weight (N)	Height of inclined plane (m)	Work machine (J)	Force to pull car up inclined plane (N)	Length of inclined plane (m)	Work done by you (J)
1						
2						
3						
4						
5						

Analysis:

1. From the table create an analysis table with the following titles:

   Work done by you is called work input (W_i)
   Work done by the machine is called work output (W_o)
   Force used by you is called force input (F_i)
   Force of car and free weight is called force output (F_o)
   Length of inclined plane is called distance input (d_i)
   Height of inclined plane is called distance output (d_o)

2. Use the above variables to develop a formula for work input and a formula for work output.
3. According to your data in Table 1, is the work you do always less than, always greater than, or always equal to the work done by the machine?
4. What do you believe is the reason for work input and work output to be different?

5. A machine's actual mechanical advantage (AMA) shows how much stronger a machine makes you while friction in the machine is taken into account. To calculate AMA, use the data that you have collected in Table 1 and divide the force output by the force input (F_o / F_i). Show your work for these calculations. Complete the table below:

Inclined plane number	1	2	3	4	5
AMA					

6. A machine's ideal mechanical advantage (IMA) shows how much stronger a machine makes you while friction in the machine is not taken into account. To calculate IMA, use the data that you have collected in the first table and divide the distance input by the distance output (d_i / d_o). Show your work for these calculations. Complete the table below:

Inclined plane number	1	2	3	4	5
IMA					

7. What happens to the ideal and actual mechanical advantage as you add more books? Why?
8. The mechanical efficiency of a machine (Eff) describes how well the machine converts work input into work output. The mechanical efficiency is found by dividing the work output by the work input and multiplying by 100 [(W_o / W_i) x 100] in order to find a percentage. The higher the percentage, the better the machine is able to overcome friction. Use the data collected in the first table to calculate the mechanical efficiency of each system and record in the table below:

Inclined plane number	1	2	3	4	5
Eff					

9. What happens to the mechanical efficiency as you add more books? Why?

<u>Conclusion:</u>

As you added more books, what happened to the force that you needed to use in order to pull the car up the inclined plane?