NAME_____

LIFTING A LOAD

Questions: Does it always take the same amount of force to lift a load? Where should you apply force in a lever system to lift a load with the least amount of force?

Predictions:

_____

_____

_____

Background Information: A lever is a simple machine that allows you to do work with less force. It will not save you any work. As with all simple machines, the lever trades distance for force.

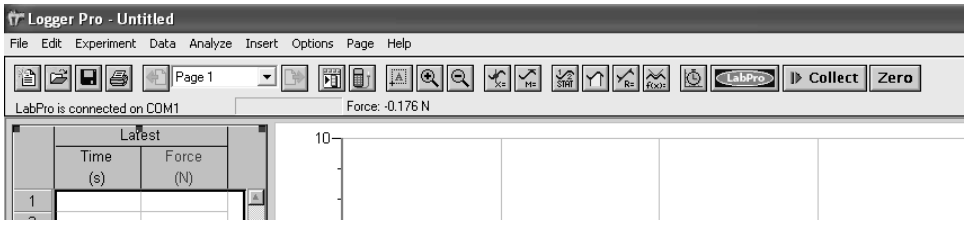
The **mechanical advantage** (MA) of a machine is the number of times the machine multiplies the force we use to do a job.
The mechanical advantage of a lever tells you how much the lever is helping beyond the force it would take you to lift the load directly.

Materials:

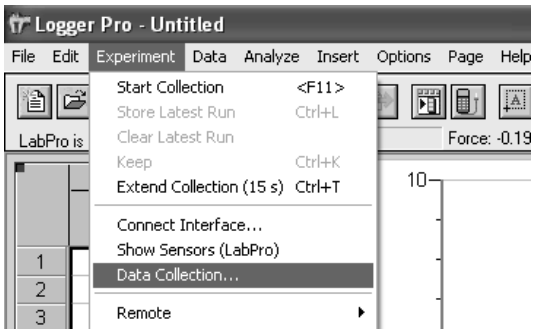
Lever system	Computer	Force sensor
LabPro data collector		

Procedure:

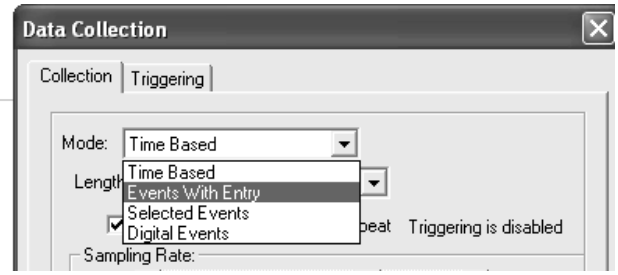
1. Set up data collecting equipment:
    a. Connect the LabPro to the computer
    b. Plug the Force Sensor into **CH1**
    c. Open the LoggerPro application
    d. You will see this screen:



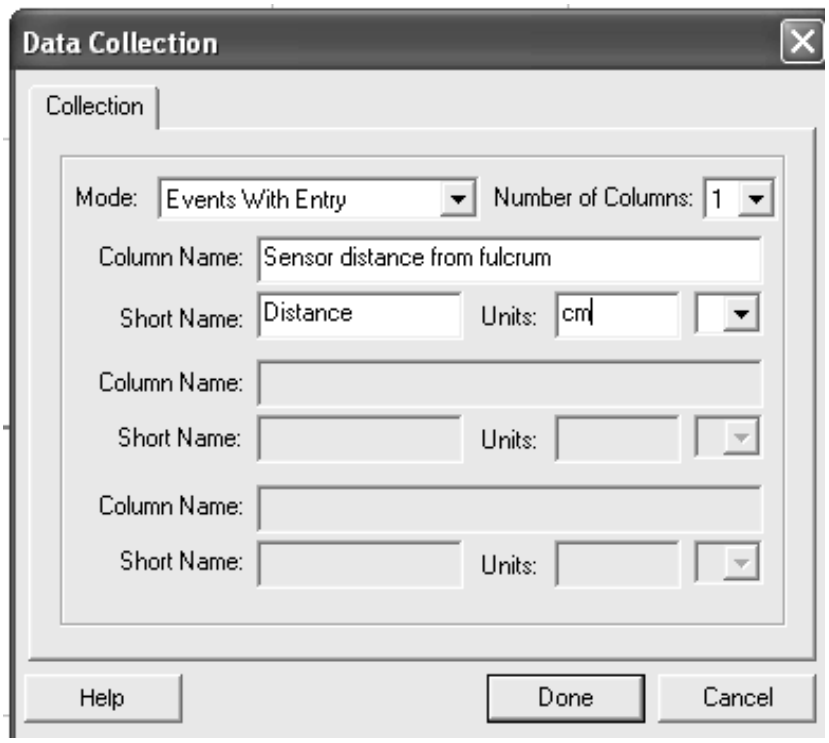
e. Go to **Experiment → Data Collection**



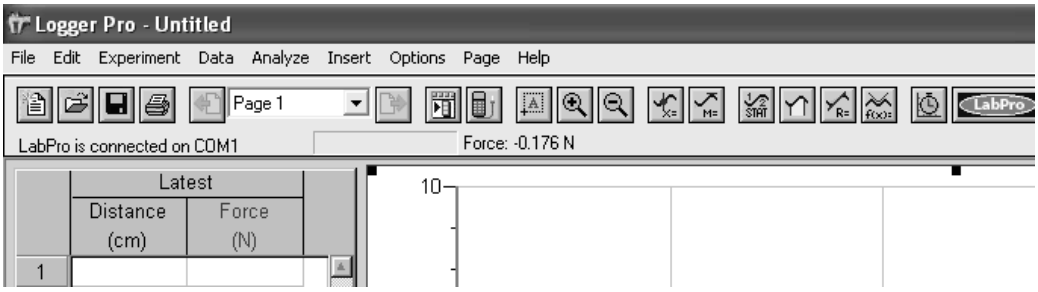
f. Choose **Events With Entry**



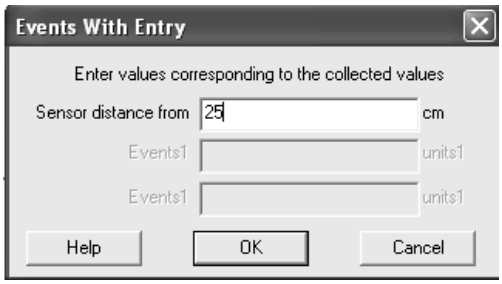
g. Label the table column:



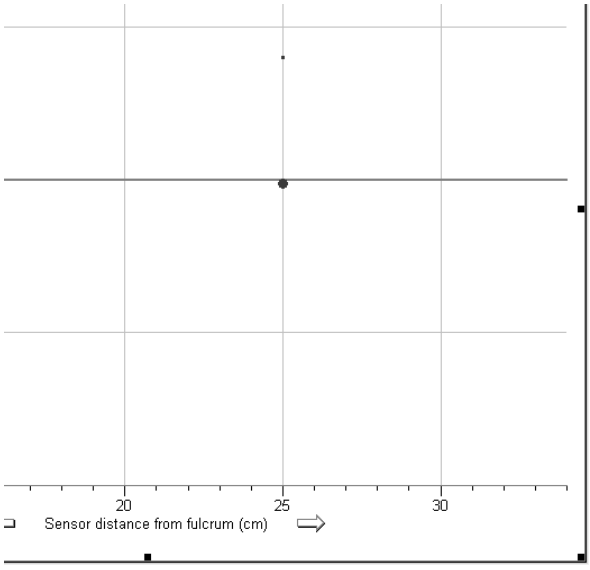
h. The table and graph are ready to collect data:

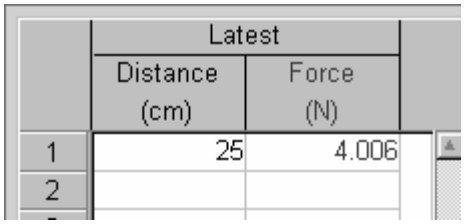


2. Using the lever set up; put the load 10.0 cm from the fulcrum.
3. Put the force sensor 25.0 cm from the fulcrum on the other side.
4. Press Collect and use the Force Sensor to pull up the load.
5. When the load has been lifted, click Keep
6. Fill in the box:



7. Clicking OK will place the data point at the 25cm mark on the graph and record the data in the table:





8. Move the force sensor to 20.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
9. Move the force sensor to 15.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
10. Move the force sensor to 10.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
11. Move the force sensor to 5.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
12. Move the force sensor to 2.5 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
13. When you have collected all of your data, click ■ Stop

Data:

Print your graph & staple it to this paper.

Data Analysis:

Describe the relationship you observe (what does the distance of effort / force from the fulcrum have to do with the force needed to lift the load?)

_____

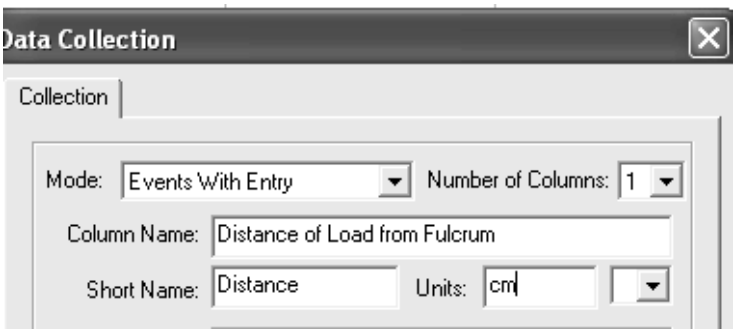
_____

_____

Part 2

Procedure:

1. Go to **File → New** to collect a new set of data. Do not save your old data.
2. Label your table:



3. Using the lever set up; put the load 25.0 cm from the fulcrum.

4. Put the force sensor 10.0 cm from the fulcrum on the other side. Measure and record the effort it takes to lift the load.
5. Move the load to 20.0 cm from the fulcrum. Leave the force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
6. Move the load to 15.0 cm from the fulcrum. Leave force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
7. Move the load to 10.0 cm from the fulcrum. Leave the force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
8. Move the load to 5.0 cm from the fulcrum. Leave the force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
9. Move the load to 2.5 cm from the fulcrum. Leave the force sensor at 10.0 cm from the fulcrum. Measure and record the effort.

Data

Print your graph & staple it to this paper.

Data Analysis:

Describe the relationship you observe (what does the distance of the load from the fulcrum have to do with the force needed to lift the load?)

_____

_____

_____

Conclusions:

1. What are the four parts of a lever system?

_____

_____

2. In what ways can a lever provide an advantage?

_____

_____

_____

3. What is the relationship between the load and effort that gives a lever user the greatest advantage?

4. When the load is at a constant position on the lever arm, how can you make it easier to lift the load?

5. What is the difference between the weight of the load and the amount of effort needed to lift it?

6. How does your graph of Part 2 compare to your graph of Part 3?

9. Predict: How much effort would it take to lift a load at 10cm if the effort were applied at 22 cm? At 13 cm? At 30cm? Explain your answers.

10. Predict: If a 4.0 N effort were required to lift the load at 10 cm, where was the effort applied? Explain your answer.

_____

_____

_____

11. How did you use the graph to make your predictions?

_____

_____

_____

_____