Name _____ Teacher _____ Period _____ Date _____

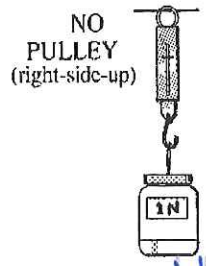
Pulley Lab

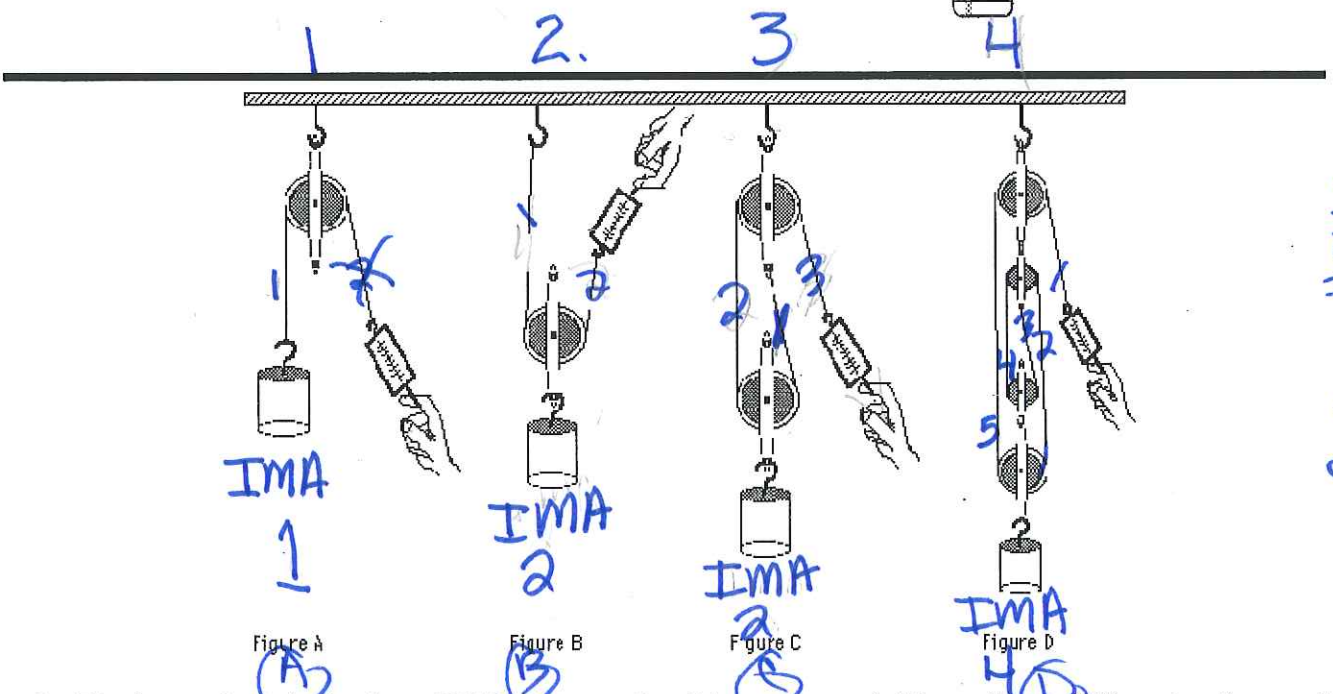
A pulley is a simple machine consisting of a wheel turning on an axle. Pulleys are often used singly and in combinations to do work. Pulleys can be found in many places such as pulling up blinds, opening a curtain for a show, in construction to lift things like with a crane, on ships to lift cargo from the dock onto the ship, flag poles, engines, pulling water up from a well, and elevators.

1. **When you first get to your lab station**: Using a spring scale, record the number of Newtons that are needed to lift the object. Do this by placing the object on the hook of the spring scale. These numbers are the output force of the object.

   Output force - 15N Newtons

   The output force is the force exerted by the machine on the object itself (or the weight of the object.)





IMA of A Pulley: Count rope segments (or last rope pulls down - don't count the last one

2. ***The input force is the force YOU exert on the object to move it.*** You will use different pulleys and pulley systems to lift the same object and record the input force.

Refer to the above diagram to set up the following pulley systems and determine the input force by pulling **on the bottom hook** of the spring scale and reading the measurement.

3. Fill in the type of pulley for Figures A and B.

Figure	Type of Pulley	Input Force
A	Fixed Pulley	16 N
B	Moveable Pulley	8 N
C	Single Pulley System	8 N
D	Double Pulley System	4 N

***For an explanation for D, see reverse side.**

Hint for Figure D:
If you do not have two double pulleys, borrow from another group.
a. Attach 1 double pulley to cabinet as shown with the bigger wheel on top.
b. **Attach paperclip w/ line to the hook on the bottom of this pulley.**
c. Loop the line around the small circle on the second double pulley and up. (This makes a movable pulley.)
d. Then up and over the top pulley's small circle.
e. Down and under the bottom pulley's larger circle.
f. Up and over the top pulley's larger circle.
g. Attach to the spring scale to this end.
h. Attach mass to the bottom pulley.
i. Pull on the hook of the spring scale to take your measurement.

Think! "small, small, large, large"

Calculating Mechanical Advantage

4. Now you will use the data you've collected to calculate the mechanical advantage of each pulley.
   a. Look at the Output Force you measured in #1 before you used any pulleys.
   b. Transfer the Output Force information into the correct box for all four different pulley types.
   c. Transfer the different Input Forces that you measured to the correct spots.
   d. Using a calculator, calculate the Actual Mechanical Advantage ($\frac{\text{Output force}}{\text{Input force}}$) for the pulley systems.

Pulley Types	Output Force In Newtons (see #1)	Input Force In Newtons	Actual Mechanical Advantage
A. Fixed Pulley	15N	16N	.9
B. Moveable Pulley	15N	8N	1.9
C. Single Pulley System	15N	8N	1.9
D. Double Pulley System	15N	4N	3.8

Conclusion Questions:

NO 1. Was the output force and the input force of the single fixed pulley the same?

2. Why is that? Friction was added by the pulley rubbing against the rope.

3. What happened to the actual mechanical advantage as you added pulleys to the system?

The more pulleys added to a pulley system the greater the mechanical advantage

yes 4. Was the work the same for all pulley systems? – W=FXD

5. So, why did some pulley systems seem easier than others? The work stayed the same, but the input (human pull) force was reduced by adding more pulleys but you will go through more rope distance