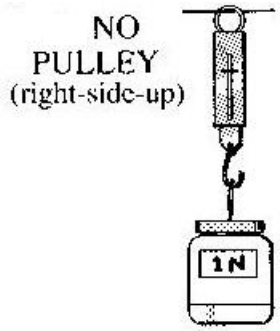
Name _____ Teacher _____ Period _____ Date _____

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 and vice versa, flag poles, engines, pulling water up from a well, and elevators.

1. Using a spring scale, record the number of Newtons that are needed to lift the object. These numbers are the output force of the object. The output force is the force exerted by the machine on the object itself (or the weight of the object.)

Output force - _____6_____ Newtons



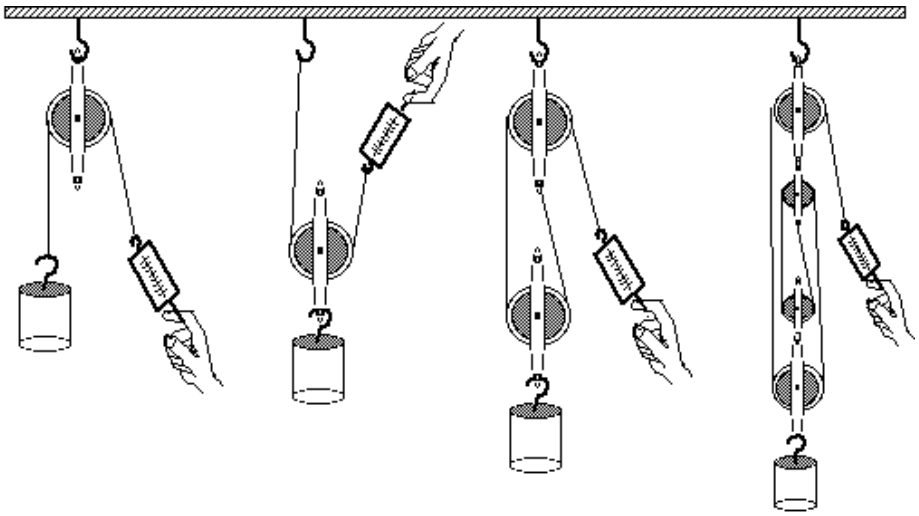


Figure A Figure B Figure C Figure D

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	6
B	Movable Pulley	~5
C	Single Pulley System	~4
D	Double Pulley System	~2

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

Hint for Figure D:

Think! "small, small, large, large"

Get 2 double-pulleys from your teacher.
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.
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.

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	Input Force In Newtons	Actual Mechanical Advantage
A. Fixed Pulley	6	**6**	**1**
B. Moveable Pulley	6	**~5**	**~1.2**
C. Single Pulley System	6	**~4**	**~1.5**
D. Double Pulley System	6	**~2**	**~3**

Conclusion Questions:

Yes 1. Was the output force and the input force of the single fixed pulley the same?

2. Why is that? **Fixed pulleys only change the direction of the force.**

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

It increased.

Yes; simple machines only make work easier, it doesn't change the amount of work to do. With all 4 pulleys, you had to lift the same weight (sand) the same distance (up)4. Was the work the same for all pulley systems?

5. So, why did some pulley systems seem easier than others? **Other than a fixed pulley the pulleys use less force but over a longer distance.**