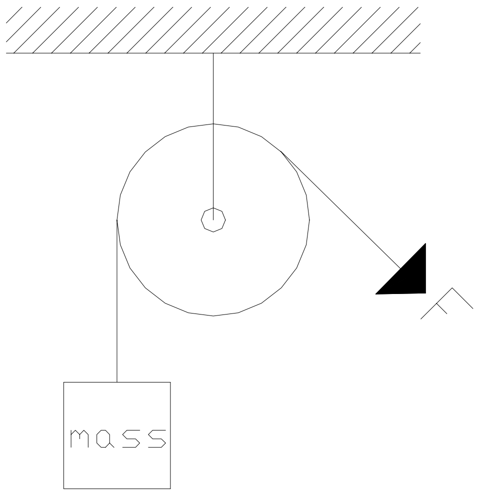
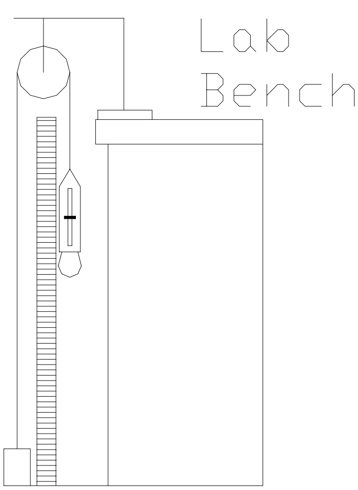
TITLE: Pulleys
Name: Rich Daubert
School: CSU
EMAIL: ALLST8BND@AOL.COM
Equipment: Pulleys, Ring Stands, Masses (50g, 100g, 200g, 500g, 1 Kg) String, Meter Sticks, C-Clamps

Suppose a force, F, is applied to the string in the picture below. Explain what the fixed pulley does to the force. Use the space to the right of the picture for your response.



Pictured below is a pulley attached to a ring stand on a lab bench. At one end of the string lies a mass of .5 Kg. At the other end, there is a spring scale used to measure force. Predict the applied force and applied distance required to lift the mass .20 meters off the floor. Record your predictions in the table below.



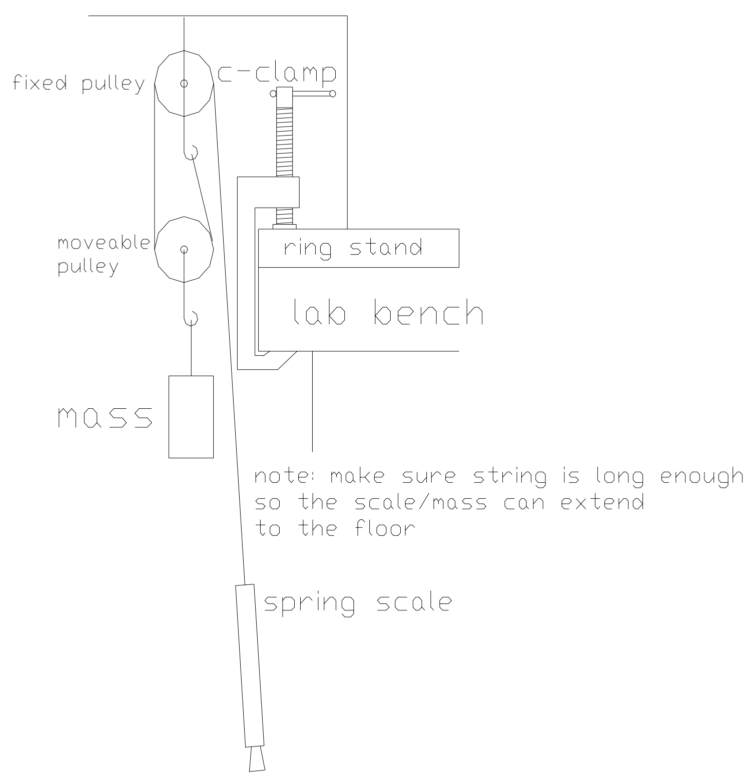
Applied Force (N)	Applied Distance (m)	Output Force (N)	Output Distance (m)
		4.9 (.5Kg)	.20

Applied Force – Force you apply to the string
Applied Distance – Distance you pull on the string
Output Force – Force applied to the mass
Output Distance – Distance the mass is raised

Test your predictions. Set up the apparatus as pictured on the previous page. Clamp the ring stand to the end of the lab bench. Use a meter stick to measure the applied distance and a spring scale to measure the applied force. Make sure you zero the spring scale in the vertical position. The output force and output distance have already been entered for you. Record your measurements below.

Input Force (N)	Input Distance (m)	Output Force (N)	Output Distance (m)
		4.9 (.5Kg)	.20

By now you should realize that pulleys are used to change the direction of an applied force. A more advanced pulley setup utilizes a fixed pulley to change the direction of an applied force as well a movable pulley to multiply the applied force. Set up the 2 pulleys as pictured below. Make sure the string is long enough so the mass can be lowered to the floor. The end of the string is tied to the hook on the fixed pulley.



Use the pulley setup from the previous page to lift the masses in the table below off the floor. Use a spring scale to measure the force you apply to lift the mass. Use a meter stick to measure the distance you move the mass off the floor (output distance). You need to simultaneously measure the distance you pull on the string (applied distance).

Trial	Applied Force (N)	Applied Distance (m)	Applied Work (J)	Output Force (N)	Output Distance (m)	Output Work (J)	Efficiency (%)
1				1.96 (200 g)			
2				3.43 (350 g)			
3				4.9 (500g)			
4				9.81 (1kg)			

Calculate the applied work for each trial by multiplying the applied force by the applied distance. Use the output force and output distance to calculate the output work for each trial. Remember, a Newton-Meter equals a Joule!

Calculate the efficiency for each trial. Efficiency = Output Work $\div$ Applied Work $\times$ 100%

In the table above, the output force should be greater than the force you applied. Draw a free body diagram in the space below to illustrate why this is so. Use the diagram on the previous page as a reference.

If the output force is greater than the input force, why isn't the output work greater than the input work?

In an ideal case, the output work will equal the input work. In this case, the efficiency of the pulley setup is 100%. Was this true for your trials? If your answer is no, explain why.