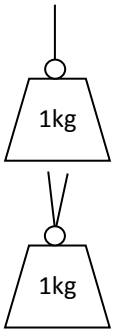
PULLEYS. Name: _____ Form: _____

Introduction: Pulleys have been used for many years to help people lift heavy loads. Archimedes is said to have been the inventor of the compound-pulley system. By arranging a series of pulleys side by side, he was able to haul a fully laden ship out of the water onto dry land completely on his own. In this prac, you will investigate how pulleys work. But first…

Picture yourself lifting up a 1kg mass with a rope. How much weight are you holding up?

_____



Now picture the rope looping under the clip. You hold one end of the rope and someone else holds the other end. How much weight are you each holding up now? Explain.

_____

_____

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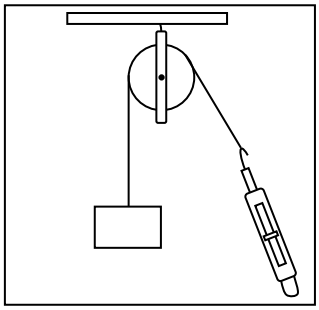
Aim: To investigate the use of pulleys in lifting loads.

Equipment: retort stands, metal bar, boss heads, string, 500g weight, spring balance, pulleys, metre ruler.

Method: Set up as shown.



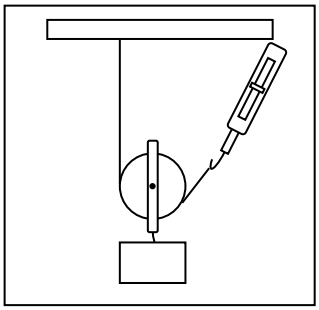
A. Hang the pulley from the metal bar.

1. How much force is required to lift the 500g weight? _____
2. What advantage does this arrangement provide for lifting a heavy object?

_____

_____

_____



B. Attach the pulley as shown.

1. How much force is required to lift the 500g weight now? _____
2. Express your answer above as a percentage of 500g.

$$\frac{force\ required}{500g} \times 100\% =$$

3. By how much has your pulling power increased?

$$\frac{500g}{force\ required} =$$

4. Why has the force required decreased?

_____

_____

5. Lift the weight up 20cm. Measure how far you need to lift the string to achieve this? _____
6. As a fraction…

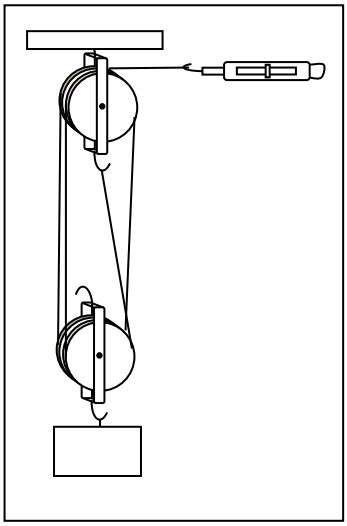
$$\frac{distance\ needed\ to\ pull}{20cm} = \qquad \frac{\qquad}{20cm} =$$

7. How do your answers to Question 3 and Question 6 compare?

_____

_____

A pulley system therefore allows you to lift a large weight with a smaller force, but you need to increase the pulling distance. On the next page, you will investigate what happens when we use more pulleys.



C. Use a double pulley to lift the 500g weight.

1. How much force is required to lift the 500g weight now? _____

2. Express your answer above as a percentage of 500g.

$\frac{force\ required}{500g} \times 100\% =$

3. By how much has your pulling power increased?

$\frac{500g}{force\ required} =$

4. What distance do you need to pull the string to move the weight 20cm.

_____

_____

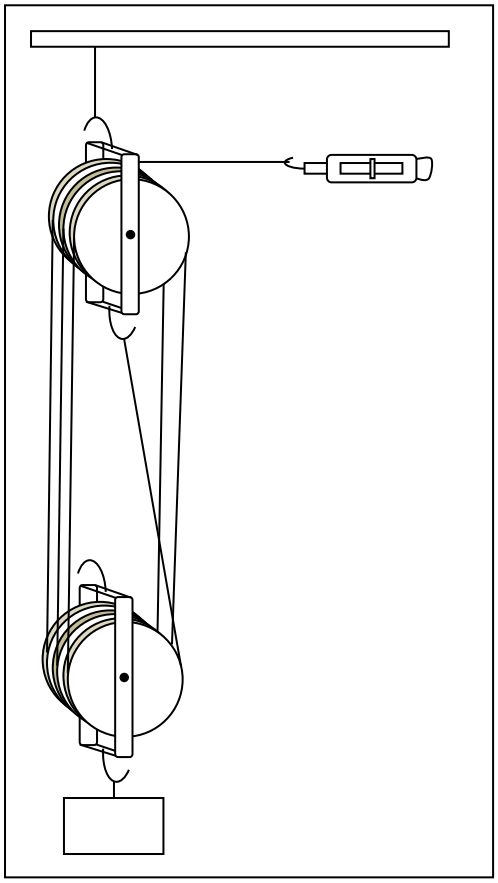
5. As a fraction…

$\frac{distance\ needed\ to\ pull}{20cm} = \frac{\quad}{20cm} =$

6. Comment on your answers to questions 3 and 5.

_____

_____



D. Use a triple pulley to lift the 500g weight.

1. How much force is required to lift the 500g weight now?

_____

2. Express your answer above as a percentage of 500g.

$\frac{force\ required}{500g} \times 100\% =$

3. Why has the force required decreased?

_____

_____

_____

4. By how much has your pulling power increased?

$\frac{500g}{force\ required} =$

5. To lift the weight up by 20cm, how far do you have to pull the string?

_____

_____

_____

6. As a fraction…

$\frac{distance\ needed\ to\ pull}{20cm} = \frac{\quad}{20cm} =$

Conclusion:

What is the relationship between the force advantage you get from pulleys and the distance that you have to pull the string?

_____

_____

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