

Name: \_\_\_\_\_

Block: \_\_\_\_\_

## Applied Science 8

### Simple Machines -- Inclined Plane and Pulley Lab

Adapted from: <https://web.wpi.edu/Images/CMS/PIEE/4q2.pdf>

#### **Vocabulary**

1. \_\_\_\_\_: The capacity to do work or cause physical change.
2. \_\_\_\_\_: A simple machine with a flat surface that is higher on one end.
3. \_\_\_\_\_: This simple machine is made up of a wheel and a rope. The rope fits on the groove of the wheel. One part of the rope is attached to the load. When you pull on one side of the pulley, the wheel turns and the load will move. Pulleys let us move loads up, down, or sideways.
4. \_\_\_\_\_: Explain that a simple machine is a device that makes work easier.
5. \_\_\_\_\_: Physical or mental effort or activity directed toward the production or accomplishment of something.

An inclined plane can:

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A pulley can:

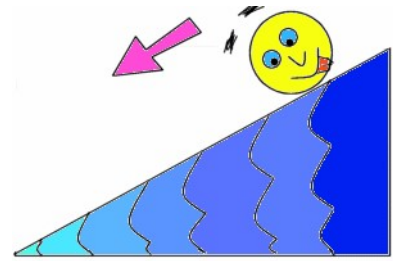
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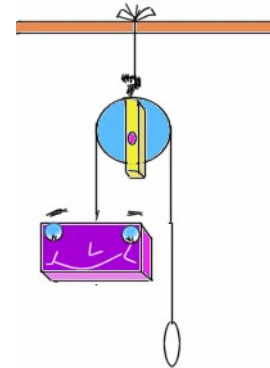
## Inclined Plane

The inclined plane is the simplest machine of all the machines that we have shown you. It is a sloping surface that connects two points together. In common English, we call it a ramp. A screw and a wedge are made up of two inclined planes. The longer the distance of the ramp, the easier it is to do the work, however, it will take a much longer time needed to do the work.

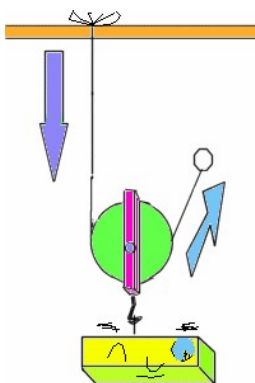


## Fixed Pulley

A fixed pulley is the only pulley that when used individually, uses more effort than the load to lift the load from the ground. The fixed pulley when attached to an unmovable object e.g. a ceiling or wall, acts as a first class lever with the fulcrum being located at the axis but with a minor change, the bar becomes a rope. The advantage of the fixed pulley is that you do not have to pull or push the pulley up and down. The disadvantage is that you have to apply more effort than the load.



## Movable Pulley

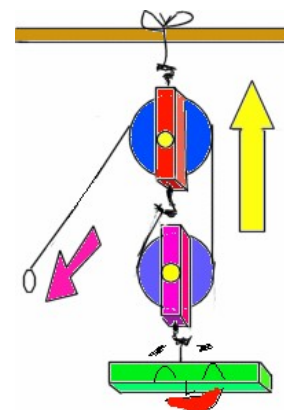


A movable pulley is a pulley that moves with the load. The movable pulley allows the effort to be less than the weight of the load. The movable pulley also acts as a second class lever. The load is between the fulcrum and the effort.

The main disadvantage of a movable pulley is that you have to pull or push the pulley up or down. The main advantage of a movable pulley is that you use less effort to pull the load.

## Combined Pulley

A combined pulley makes life easier as the effort needed to lift the load is less than half the weight of the load. The main advantage of this pulley is that the amount of effort is less than half of the load. The main disadvantage is it travels a very long distance.



### Experiment 1: Inclined Planes

1. Lift one end of a desk using 4-6 books to create an inclined plane.



2. Tie the weight to a spring scale and lift it vertically till it goes at the same height as the top of the books.

How much force was needed to lift the weight? Record it on your data sheet. Be sure to measure the length of the inclined plane (the board) and the height of the inclined plane (height of the books) to record on your data sheet.



3. Pull the weight up the incline plane. How much force is needed? Record it on your data sheet.

4. Repeat the experiment using different number of books for the inclined plane. How much force is needed? Record it on your data sheet. Do this for a total of three different inclines.

5. Answer the questions on your data sheet about using this type of simple machine.

#### Data Sheet

Force to lift the weight when no inclined plane was used: \_\_\_\_\_.

Length of inclined plane	Height of the inclined plane	Force used

Conclusion: What can you say about the relationship of the height and length of the inclined plane and the force used?

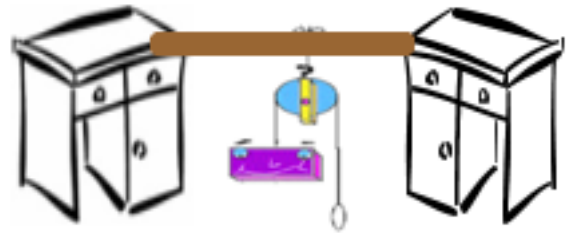
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## Experiment 2: Pulleys

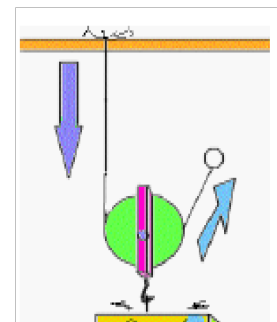
1. Set up a fixed pulley like in the picture below. Rest the long board from Experiment 1 between two desks. Tie the fixed pulley to the middle of the board. Attach the weight to one end of the string (the weight is represented by the block). Attach the pull scale to the other end of the string.



Pull down on the pull scale until you lift the weight. Record how much force is needed to lift the weight and measure how high you lift the weight on your data sheet.

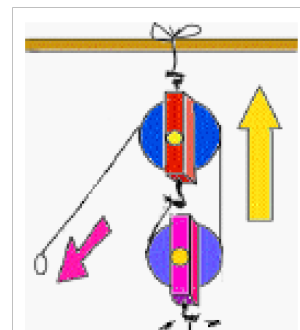
2. Set-up a movable pulley for the next test. A movable pulley is shown at right. Attach one end of the string to the board and the other end of the string to the pull scale.

Pull up on the pull scale to lift the weight. Lift it the same distance you lifted it using the fixed pulley. Measure the force and record it on your data sheet.



3. Set-up a combined pulley for the next test. A combined pulley is shown at right

Lift the weight with the combined pulley (the weight is represented by the bottom block). Lift the weight the same height it was lifted in the earlier experiments. Record the force and height on your data sheet.



### Experiment #2 Data Sheet

Type of pulley	Number of pulleys	Force used

Conclusion: What can you say about the relationship of the type of pulley and force used to lift the weight?

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