Simple pulley experiments

Overview: Ever wonder how pulleys work, and how you can use them to lift ten friends with only one hand? We'll explore this today.

What to Learn: Pulleys are like other simple machines in that they help us do work by changing the direction or strength of a force.

Materials

- One pulley (from the hardware store… get small ones that spin as freely as possible. You'll need three single pulleys, or if you can find one get a double pulley to make our later experiment easier.)
- About four feet of string
- 2 paper cups
- Many little masses (about 50 marbles, pennies, washers etc.)
- Yardstick or measuring tape
- A scale (optional)
- 2 paper clips
- Nail or some sort of sharp pokey thing
- Table

Lab Time

1. Use the nail to poke a hole in both sides of the cup. Be careful to poke the cup … not your finger! Thread about 4 inches of string or a pipe cleaner through both holes. Make sure the string is a little loose. Make two of these mass carriers. One is going to be your load (what you lift) and the other is going to be your effort (the force that does the lifting).
2. Dangle the pulley from the table.
3. Bend your two paper clips into hooks.
4. Take about three feet of string and tie your paper clip hooks to both ends.
5. Thread your string through the pulley and let the ends dangle.
6. Put 40 masses (coins or whatever you're using) into one of the mass carriers. Attach it to one of the strings and put it on the floor. This is your load.
7. Attach the other mass carrier to the other end of the string (which should be dangling a foot or less from the pulley). This is your effort.
8. Drop masses into the effort cup. Continue dropping until the effort can lift the load.
9. Once your effort lifts the load, you can collect some data. First, allow the effort to lift the load about one foot (30 cm) into the air. This is best done if you manually pull the effort until the load is one foot off the ground. Measure how far the effort has to move to lift the load one foot.
10. When you have that measurement, you can either count the number of masses in the load and the effort cup or if you have a scale, you can get the mass of the load and the effort.
11. Write your data into your pulley data table in your worksheet below.

Pulleys Data Table

Distance lifted	**Amount of coins needed to lift**
1 inch	
3 inches	
6 inches	
1 foot	

Reading

Pulleys are one of six types of simple machines. These are very obviously designed to change the direction of a force for the key purpose of the simple machine: to do work.

When we played with levers we could see that, by using a simple machine, we were able to use less force to move a heavy object than we would have had to use if we didn't use a simple machine. We also saw that with that lessening of force came an increase in distance.

Obviously, you can only make a lever so long. After a while it gets kind of ridiculous. Imagine lifting a concrete block or a car with a lever. That's a big lever, and you probably still wouldn't be able to lift the car very high. This is where pulleys come in.

By the use of a pulley (otherwise known as a block and tackle), car mechanics lift 600-lb car engines with one hand! Cranes that lift steel girders and thousand-pound air conditioning units are basically pulleys! (By the way, Archimedes is credited for inventing the crane. He actually used a crane as a weapon to defend Syracuse from Rome.)

Exercises Answer the questions below:

1. What is the load and effort of a pulley? Draw a pulley and label it.

2. What is the best way to say what a simple machine helps us do?
    a. Do work without changing force applied
    b. Change the direction or strength of a force
    c. Lift heavy shipping containers
    d. None of these
3. Name one other type simple machine and an example:

Answers to Exercises: Simple Pulley Experiments

1. What is the load and effort of a pulley? Draw a pulley and label it.
2. What does a simple machine help us do? (direct force in a different direction or magnitude)
3. Name one other type simple machine and an example: (inclined plane or lever)