See-saw

Overview: We're going to use everyday objects to build a simple machine and learn how to take data.

What to Learn: A lever is designed to take a force and apply it somewhere else so that we can do work.

Materials

- A wooden ruler or a paint stick for the lever
- Many pennies, quarters, or washers (many little things of about the same mass)
- A spool, eraser, pencil (anything that can be your fulcrum)
- A ruler (to be your um….ruler)
- Paper cups
- Optional: A scale that can measure small amounts of mass (a kitchen scale is good)

Lab Time

1. Tape one paper cup to each end of the lever. (This allows for an easy way to hold the pennies on the lever.)
2. Set your fulcrum on the table and put your lever (ruler or paint stick) on top of it. Try to get the ruler to balance on the fulcrum.
3. Put five pennies on one side of your lever.
4. Now, put pennies, one at a time, on the other side of your lever, this is your effort. Keep adding pennies until you get your lever to come close to balancing. Try to keep your fulcrum in the same place on your lever. You may even want to tape it there.
5. Count the pennies on the effort side and count the pennies on the load side. If you have a scale, you can weigh them as well. With the fulcrum in the middle, you should see that the pennies/mass on both sides of the lever are close to equal.
6. This part's a little tricky. Measure how high the lever was moved. On the load side, measure how far the lever moved up and on the effort side measure how far the lever moved down. Be sure to do the measuring at the very ends of the lever.
7. Write your results in your worksheet.
8. Remove the pennies and do it all over again, this time moving the fulcrum one inch (two centimeters) closer to the load side.
9. Continue moving the fulcrum closer to the load until it gets too tough to do. You'll probably be able to get it an inch or two (two to four centimeters) from the load.
10. If you didn't use a scale, feel free to stop here. Don't worry about the "work in" and "work out" parts of the table. Take a look at your table and check out your results. Can you draw any conclusions about the distance the load moved, the distance the effort moved, and the amount of force required to move it?

See Saw Data Table

Placement of load	How high did the lever move? (inches)
Beginning	
1 inch closer to load	
2 inches closer to load	
3 inches closer to load	

Remember that levers have three parts: the work, effort, and the load. In this case, there are two loads, distributed at different points on the effort. The fulcrum and its distance to the load will determine what kind of data we'll get at the end of this experiment.

Reading

How powerful are simple machines? Do you believe that they can help you do work?

Archimedes (286 to 212 B.C.) said, "Give me a place to stand and I can move the Earth." As you can see, Archimedes was quite fond of simple machines. In fact, he was a master of all the simple machines. He did not invent them, but he did put them to some amazing uses.

For example, a story goes that the Greek king Hiero had a problem. He had had a boat made that was so large no number of men could get it into the water. What good is a boat that is stuck on land? The king told Archimedes his problem, and Archimedes claimed that he could launch that boat with one hand. After several days, Archimedes created a system of levers and pulleys that allowed him to move the boat by himself, with one hand. Archimedes was an unbelievable scientist and mathematician.

Exercises Answer the questions below:

1. What is work?
    a. Force against an object
    b. Force over distance
    c. 9 hours and sweat
    d. Energy applied to an object
2. What is the unit we use to measure energy?
    a. Newton
    b. Watt
    c. Joule
    d. Horsepower
3. Describe a first class lever using one example.

Answers to Exercises: See-saw

1. What is work? (force moved over a distance)
2. What is the unit we use to measure energy? (Joule)
3. Describe a first class lever using one example. (a hammer, crowbar, or scissors works well)