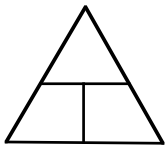
Lever Notes

Of the six basic types of simple machines, the lever was probably the first one used by man. By definition, it is a rigid bar or rod that is able to pivot around a fulcrum.

To make a bar or rod act as a lever you must place it against a pivot point called a fulcrum. Like all simple machines the lever uses the effort force put into it to perform work. As you found out in doing the lever lab, some of your lever setups were balanced and some were not. In order for a lever to balance, the forces acting on each side of the lever must equal each other. Since all levers involve a turning motion around the fulcrum, the forces they produce also move around the fulcrum. This turning force around the fulcrum, axis or pivot point is called torque. Another way to define torque is " a force that causes twisting, turning, or rotation around a fulcrum, axis or pivot point ".

Torque can be calculated by using the following formula:



Torque = force (or weight) x distance (from fulcrum)

The metric units for torque are Newton-meters, while the imperial units for torque are foot-pounds.

A balanced lever does not rotate because the torque on each side of the fulcrum is the same. If the torque on one side of the fulcrum is not the same as the torque on the other side then the lever is unbalanced, and it will rotate.

This can be summarized in a rule called " The Law of Levers ".

Left side torque = Right side torque

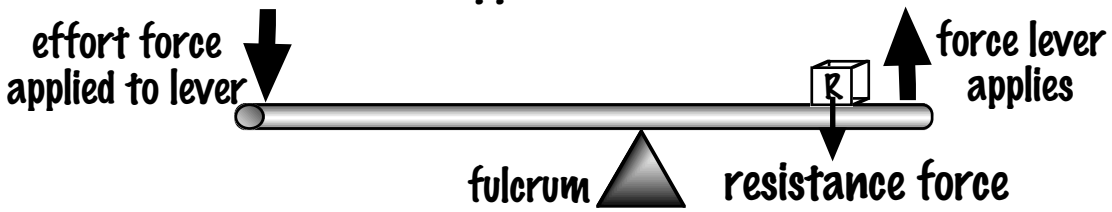
Sum of the individual torque on left side = Sum of the individual torque on right side

Question : How can a single weight on a lever produce different amounts of torque?
Answer: By Changing Its Distance From The Fulcrum. There is a direct relationship between distance of the force from the fulcrum and the torque it produces. Increase the distance and the torque increases and vice versa.

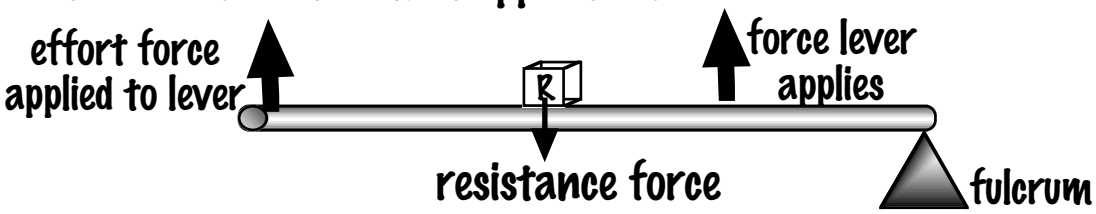
Types Of Levers

There are three classes of levers. In each class of lever there is an effort force, a resistance force, and a position for the fulcrum. Each class of lever has one of these three things positioned in the middle of the lever.

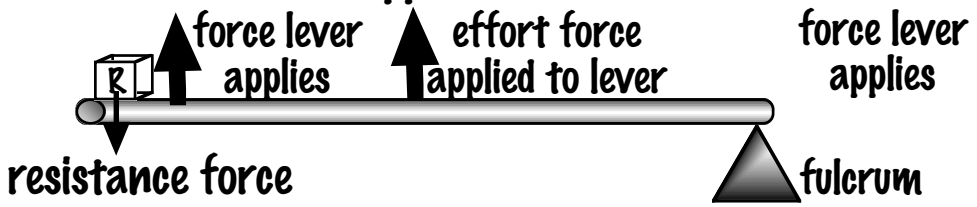
In a first-class lever, the fulcrum is positioned in the middle, with the effort force and resistance force at opposite ends.



In a second-class lever, the resistance force is positioned in the middle, with the effort force and fulcrum at opposite ends.



In the third-class lever, the effort force is positioned in the middle, with the resistance force and the fulcrum at opposite ends.



An easy way to remember which type of lever is which, is to remember the following sequence of letters: FRE. Since the first letter is "f " it means in a first-class lever, the fulcrum is in the middle position. The second letter is "r " which means in a second-class lever, the resistance force is in the middle position. The third letter is "e " so this means in a third class lever, the effort force is in the middle position.