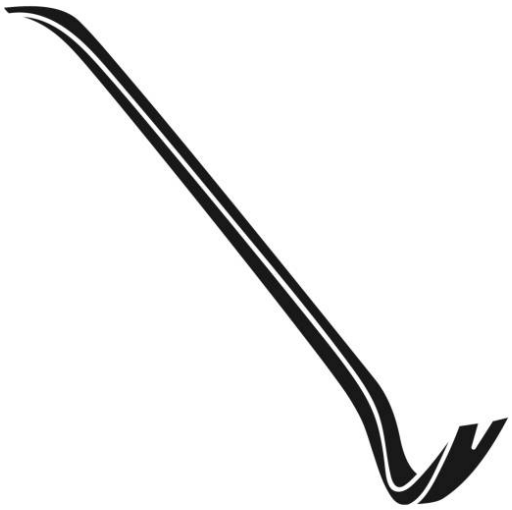
BIKE WORKS

Levers & Bicycles

Reading

In this lesson, you learn about **levers** and how they apply to bicycles. You probably know from school that a lever is a simple machine often used to allow people to use small amounts force in order to move some object. Levers are some of the most basic and fundamental tools that are useful almost anywhere physical work is involved. Levers play a huge part in our everyday lives in anything ranging from an oar to a crowbar to things less commonly thought of as levers such as a baseball bat or even your own arm. You will learn here about the different types of levers that exist as well as central concepts behind how a lever works. Additionally, you will learn about how levers are related to different tools and finally how they come together to allow the operation one of the coolest machines in the world, the bike!

To make a lever all that is needed is a *pivot point* (usually called the *fulcrum*), a *load*, and a *force* applied to move that load. The force is normally applied along a *lever arm*. A lever arm is anything that is attached to the pivot point and rotates around the pivot point in a circular fashion. The load is whatever object the lever is trying to move. A basic type of lever you have probably seen a million times is shown below.



There are actually three main types of levers. The lever above is called a *class 1 lever*. In a class 1 lever, force is applied to the lever arm on one side of the fulcrum while on the other side of the fulcrum the load is moved.

Class 1 levers can be seen in things like see-saws, oars, and crowbars. To use the crowbar as an example, if we are trying to pry a nail out of a board, we place the claw part of the crowbar under the nail and push down on the other end. We see how the pivot point occurs where the crowbar meets the board, the load is the nail we are trying to pry and the force is give by us pushing down on the long end of the crowbar. We can see that the pivot point occurs between the load and the force applied, so we see that the crowbar must be a class 1 lever.

Other machines, such as scissors, pliers, cable cutters, and staplers, use two class 1 levers at the same time to accomplish their job. In all these machines, we can see that the pivot point is located somewhere between the force applied and the load. This is what defines them as class 1 levers.

Class 2 levers are levers where the load is located somewhere between the force and the pivot.

Examples of class 2 levers are seen in such things as nutcrackers, bottle openers, and wheelbarrows. Do you see how a wheelbarrow can be seen as a class 2 lever?

Class 3 levers are the final type of lever in which the force is actually located in between the load and the pivot.

This type of lever is often seen in machines, which try to move lighter loads at fast speeds. Baseball bats, tennis rackets, catapults, and brooms are all members of this category.

Levers can sometimes show up, though, in forms where they cannot be classified as one of these three types of levers for some reason or another. Things such as doorknobs, faucet handles and screwdrivers all have the parts of a lever (load, force, and pivot) yet due to their circular shapes, it is not possible to say that the force is on one side of the pivot and the load is on another. These types of levers, however, we can call **continuous levers** because their force and load are applied over a continuous circle rather than at a fixed point.

So that basically sums up what different kinds of levers there are: Class 1, 2, 3, and continuous levers. In summary, though, levers can be defined as anything that has some sort of load, pivot point and a force applied in order to move that load.

Experiment

Get your bike and put it up on a stand. Look at all its parts and write down everything on the bike that could be classified as a lever. Pull them, push them, shake them, do anything you need to see if they satisfy the criteria for a lever. Then, after you have identified all the levers, make a drawing for each lever you found showing where are its pivot, load and force and write down what type of lever it is. There are plenty of levers on any bike so if you don't find them all, don't worry.

If you want to send in your experiment findings for a cool prize email us at: programs@bikeworks.org