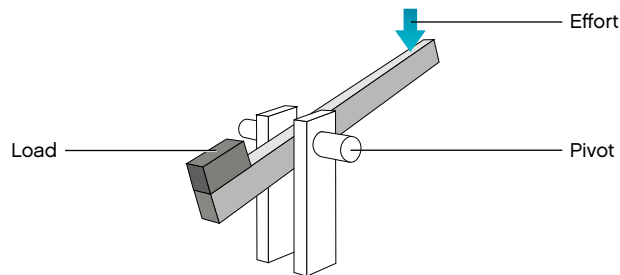


## Overview: Levers



A lever is most commonly defined as a rod or arm that tilts around a pivot, also called a fulcrum, to produce useful motion. The load is moved by the effort (a push or pull) used to make the lever tilt about the pivot. With a lever arm or lever beam, a load can be lifted with the least effort by placing it as close to the pivot as possible, or by applying the effort as far from the pivot as possible.

There are three main arrangements of the pivot, load, and effort, creating three types or classes of levers. A first class lever has the pivot between the effort and load, and is used to do work and to produce useful movement. A second class lever has the load between the effort and pivot, and is used mainly to do work. A third class lever has the effort between the pivot and load, and is used mainly to amplify movement.

Levers can be used to create the following effects:

- To apply a force at a distance
- To change the direction of a force
- To increase force
- To increase movement

Levers are found in many machines, such as wheelbarrows, oars, rakes, nutcrackers, tweezers, screwdrivers, snow shovels, hammers, bottle openers, light switches, staplers, crowbars, scissors, and seesaws.



### Did you know?

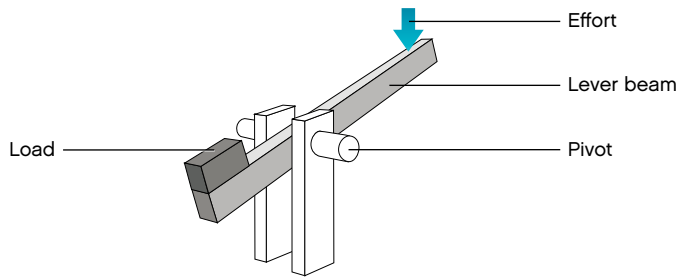
Levers make work easier by amplifying motion or force, or by changing the direction of a force.

### Establishing the Concept

We recommend establishing the concept of the simple machine to be worked on. This could be done, for example, by showing students a number of exhibits from the LEGO® set to stimulate their interest. Build a principle model, or show some of the images from Images for Classroom Use, asking questions such as “What do you know about this simple machine?” or “Where do we use this simple machine?” See if students can name any of the objects you show them, and allow time for students to handle them.

### Providing the Vocabulary

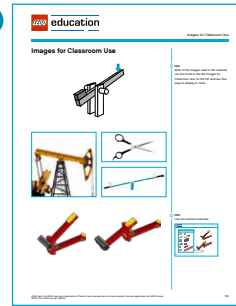
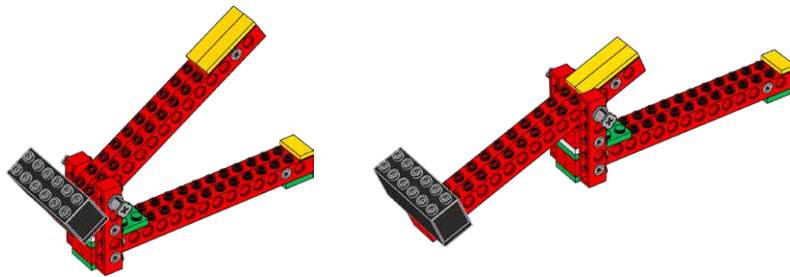
Students will acquire the necessary vocabulary for the simple machine as they progress through the activities, but it may be useful to introduce certain terms at this stage. Important new vocabulary items are *effort*, *load*, *pivot*, and *lever beam*.



### Understanding the Principles

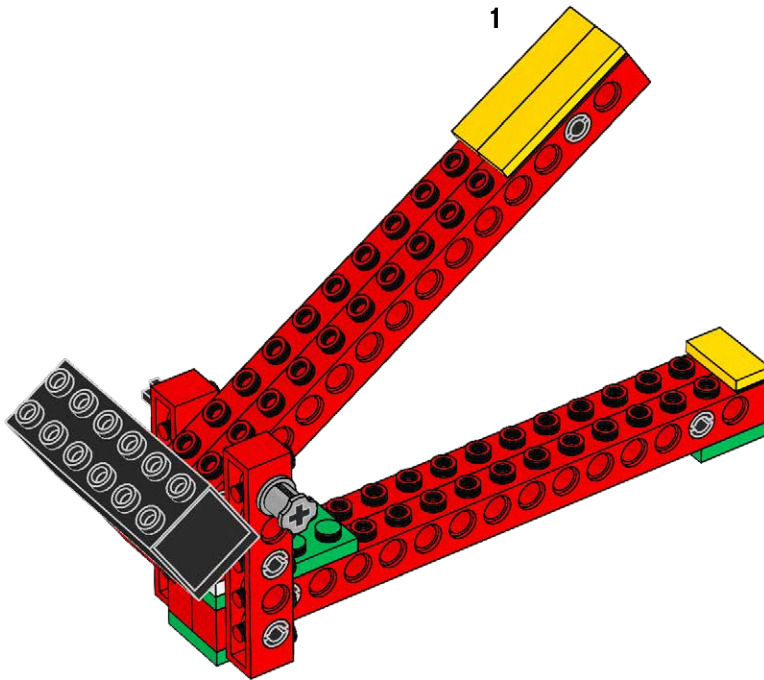
The principle models are designed to help students understand the principles of the simple machine in focus through hands-on experience before they move on to construct the main models.

The principle models are presented in a logical sequence that will build on students' understanding. The principle models can only be built one at a time from the parts in the set.



## Using the Principle Models

1. The yellow elements indicate where to hold, push, lift, or apply force/effort in handling the principle models. The principle models need to be held correctly if they are to work properly.



### First Class Lever

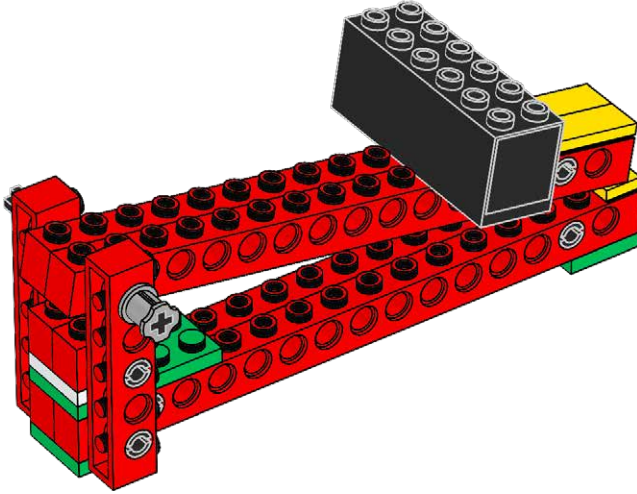
A first class lever has the pivot placed between the effort and the load. This type of lever changes the direction of the effort force and can change the amount of effort needed to lift or move a load. A seesaw is an example of a first class lever.

#### Hint

It is possible to introduce second and third class levers simply by rebuilding the model. See next page.

## Second Class Lever

A second class lever has the load placed between the effort and the pivot. This type of lever does not change the direction of the effort force, but can reduce the amount of effort needed to lift a load. A wheelbarrow is an example of a second class lever.



### Did you know?

Levers can be connected together through a common pivot to produce useful tools and mechanisms; scissors, nutcrackers, and tweezers are all connected levers.

## Third Class Lever

A third class lever has the effort between the load and the pivot. This type of lever does not change the direction of the effort force, but can increase the distance the effort moves a load. A broom is an example of a third class lever.

