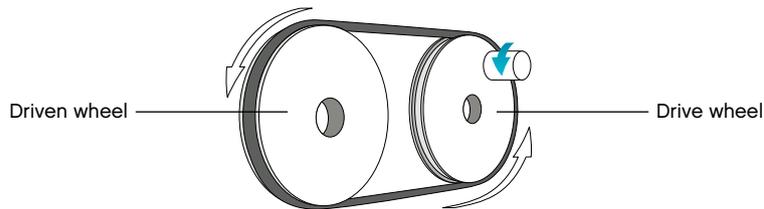


## Overview: Pulleys



A pulley is most commonly defined as a wheel with a grooved rim for a belt or rope. A belt connecting pulleys can “slip”, meaning that the effort is not being used efficiently. This can happen either when the pulley belt is too loose, or if the pulley wheels differ in size. On the other hand, if the pulley belt is too tight, the belt will create wasteful friction forces on the pulley.

Pulleys can be used to create the following effects:

- To change the orientation of a pulling force
- To change the direction of rotation
- To change the orientation of a rotating movement
- To increase a pulling force
- To increase or decrease the speed of rotation
- To increase turning force, also called torque

Pulleys are found in many machines, such as fan belts, elevators, steam shovels, flagpoles, clothesline pulleys, cranes, old-fashioned wells, blocks and tackle, winches, wire stretchers, and Venetian blinds.



### Did you know?

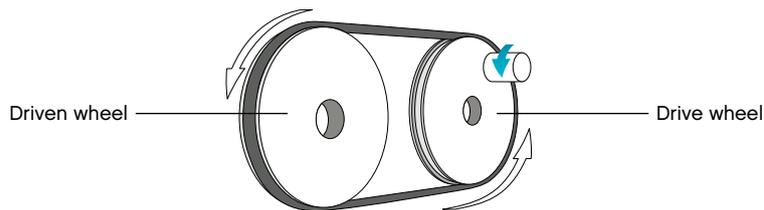
Pulleys connected by a belt have a trade-off between turning force and turning speed. In general terms, you lose in turning force what you gain in turning speed, and vice versa.

## 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 *drive wheel* and *driven wheel*.

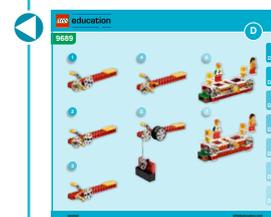
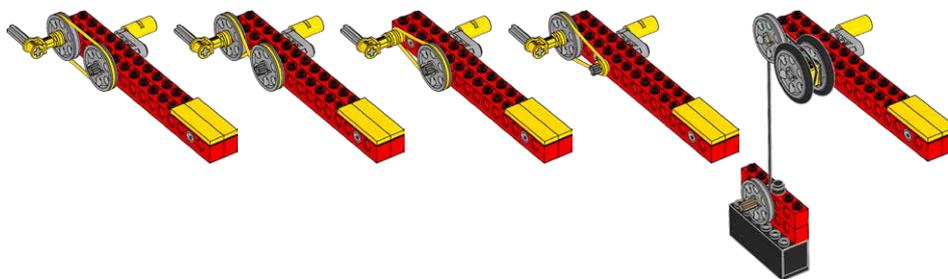


The pulley that is turned by an outside force, such as that from a motor or from a person turning a handle, is called a drive or the drive wheel. When this turns at least one other pulley by a belt, the next pulley is called the driven wheel (or follower).

## Understanding the Principles

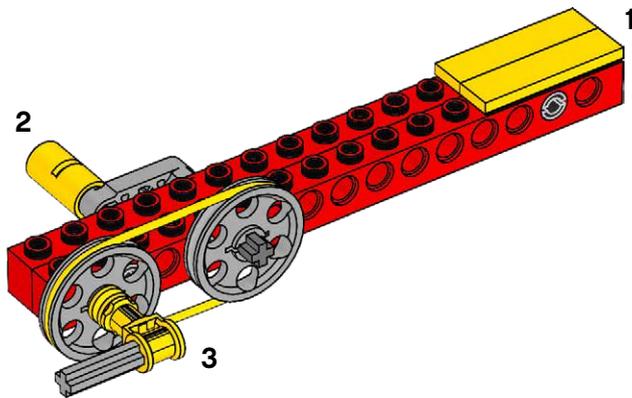
The principle models are designed to help students understand the principles of the simple machine in focus through hands-on experience before they move on to construct the main models.

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 for them to work properly.
2. When measuring one turn of the handle, carefully observe the starting place of the handle and be careful to stop at the same position after a full turn.
3. When measuring a full turn of the position marker, carefully observe the starting place of the position marker and be careful to stop at the same position after a full turn. This is especially important when observing the connection between cranking the handle and the number of turns the position marker makes.



### Hint

The principle models can be built as mirror-images for left-handed students.

### Hint

It is recommended that students work in pairs; one student can observe the position marker while the other cranks the handle a full turn.