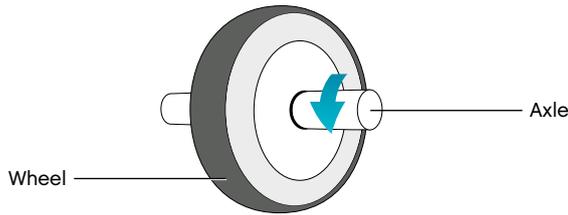


Overview: Wheels and Axles



A wheel is most commonly defined as a solid disk or as a circular ring with spokes, designed to turn around a smaller axle (a rod) passing through its center. The circle traced in the air by a crank handle is also a wheel. As the crank handle goes round, the crank turns an attached axle. The wheel and attached axle both turn at the same speed. However, the force needed to turn one or the other differs, because the diameter of the wheel is larger than that of an axle. Applying a small force to turn the larger wheel produces a larger force to turn the smaller axle, as in a winch, for example.

Wheels and axles can be used to create the following effects:

- To control the direction of movement
- To increase turning force, also called torque
- To reduce friction and to make objects easy to move

Wheels and axles are found in many machines where there is a need to control the direction of movement and turning force, such as windmills, bicycles, roller skates, vehicles, rolling pins, helicopters, fishing reels, trolleys, strollers and door knobs.



Did you know?

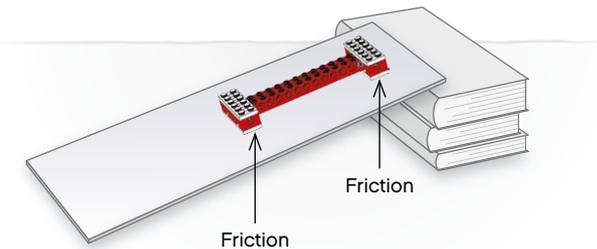
A disk is only a wheel when an axle runs through it.

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 one important term at this stage, namely *friction*.

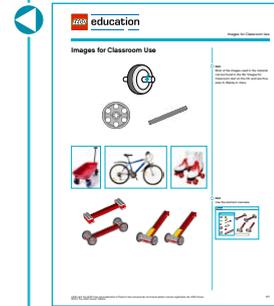
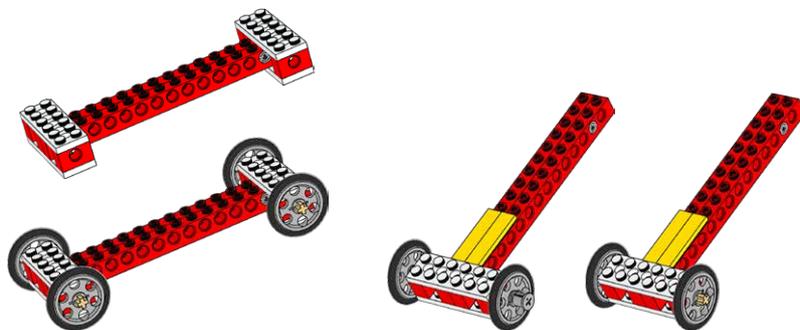


Friction is the resistance met when one surface slides over another; this affects movement (see the “Glossary” section). The effects of friction can be tested using the principle models.

Understanding the Principles

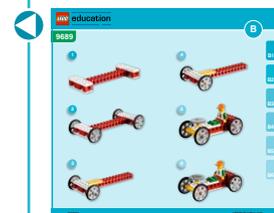
The principle models are designed to help students understand the principles of the simple machine in focus through hands-on experience before they move on to construct the main models.

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.



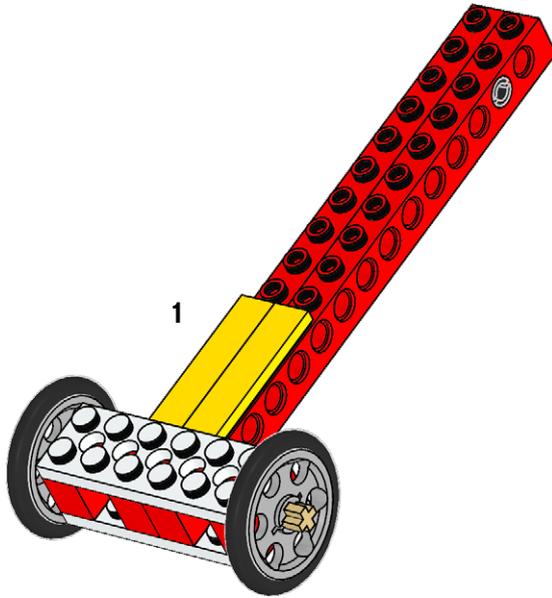
Hint

To introduce the term, it may be useful to bring some rough and smooth objects into class and show that it is harder to slide two rough objects over each other than two smooth objects.

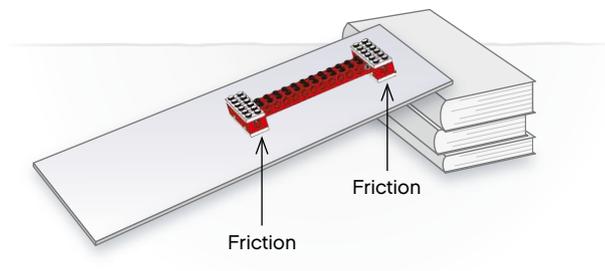


Using the Principle Models

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. It is important for students to understand what friction is before working with the wheel and axle principle models. Friction makes a moving object tend to slow down and eventually stop unless additional force is applied, e.g., when two objects move against each other.



3. A ramp will be needed to test the first two principle models, B1 the sliding model and B2 the rolling model. Build a simple ramp by using books for height and a plank of wood or piece of stiff cardboard for the ramp.