



## Curiosity Guide #301

### Wheel and Axle

Accompanies Curious Crew, Season 3, Episode 1 (#301)

#### Difficult Doorknobs

Investigation #1

#### Description

Why do doors have doorknobs? Find out with this simple investigation.

#### Materials

- Doorknob and post (not attached to a door)

#### Procedure

- 1) Unscrew the knob from one side of the doorknob, leaving the other knob attached. (You should be able to slide the knob back on the shaft fairly easily in step #4.)
- 2) Challenge a friend to turn the doorknob by grabbing only the shaft.
- 3) Was it difficult?
- 4) Slide the knob back on the shaft and try it again.
- 5) Why would there be a difference?

#### My Results

## Explanation

A doorknob is an example of a simple machine known as a wheel and axle. The wheel and axle machine consists of a round wheel that works together with an axle so that the two rotate together. This simple machine works in the same way as a first-class lever. The fulcrum is the axle to which the wheel applies a force.

In many cases, the wheel can rotate a full 360 degrees. For example, a doorknob is an example of a wheel and axle in which the knob itself acts as the wheel, and the shaft of the lockset acts like the axle. It is important to note that the "wheel" in this scenario does not have to act like a wheel at all, but is a rounded object that rotates. The wheel, which works with the axle, generally has a larger diameter than the axle.

There is also a trade off in the amount of effort applied to a wheel and axle. A larger wheel requires less effort to turn. However, to produce the same amount of work, the larger wheel travels a greater distance than a smaller wheel does. A doorknob is a force multiplier. By applying the effort on the wheel, the force is multiplied on turning the axle.

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