

# Newton's First Law of Motion

**Overview:** The natural state of objects is to follow a straight line. In fact, Newton's First Law of Motion states that objects in motion will tend to stay in motion unless they are acted upon by an external force. A force is a push or a pull, like pulling a wagon or pushing a car. Gravity is also a force, but it's a one-way force that attracts things to each another.

**What to Learn:** The way to change how something is moving is to give it a push or a pull. The size of the change is related to the strength, or the amount of "force," of the push or pull.

## Materials

- wagon
- rocks
- friends
- stopwatch
- meterstick or yardstick or measuring tape

## Lab Time

1. Let's really figure out what this "inertia" thing from Newton's first law is all about using the wagon and friends. Pull the wagon down the sidewalk.
2. Try to stop as quickly as you can. Be careful. You could get run over by the wagon if you're not careful.
3. Put a friend in the wagon and repeat steps above.
4. Put another friend in the wagon and repeat again.

You may have noticed that the more friends (the more weight) you had in the wagon the harder it was to get moving and the harder it was to stop. This is inertia. The more weight something has the more inertia it has and the harder it is to get it to go and to stop!

## Newton's First Law of Motion Data Table

Number of Kids in Wagon	Time to Stop <i>(measure in seconds)</i>	Distance to Stop <i>(measure in feet or meters)</i>

### Reading

What happens when you kick a soccer ball? The "kick" is the external force that Newton was talking about in his first law of motion. What happens to the ball after you kick it? The ball continues in a straight line as long as it can, until air drag, rolling resistance, and gravity, all of which cause it to stop.

If this seems overly simplistic, just stick with me for a minute. The reason we study motion is to get a basic understanding of scientific principles. In this experiment, the ball wants to continue in a straight line but due to external forces like gravity, friction, and so forth, the ball's motion will change.

Newton's First Law of Motion also says that objects at rest will tend to stay at rest, and objects in motion tend to stay in motion unless acted upon by an external force. You've seen this before – a soccer ball doesn't move unless you kick it. But what happens if you kick it in outer space, far from any other celestial objects? It would travel in a straight line! What if it wasn't a soccer ball, but a rocketship? It would still travel in a straight line. What if the rocket was going to pass near a planet? Do you think you'd need more or less fuel to keep traveling on your straight path? Do you see how it's useful to study things that seem simple at first so we can handle the harder stuff later on?

**Exercises** Answer the questions below:

1. What is inertia?
2. What is Newton's First Law?
3. Will a lighter or heavier race car with the same engine win a short-distance race (like the quarter-mile)?

### **Answers to Exercises: Newton's First Law of Motion**

1. What is inertia? (the resistance something has to change its motion)
2. What is Newton's First Law? (Objects at rest stay at rest, and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.)
3. Will a lighter or heavier race car with the same engine win a short-distance race (like the quarter-mile)?