Teacher Tune-up

Quick Content Refresher for Busy Professionals

How is mass different from weight?

Mass

(also called *inertial mass*) is the amount of matter an object consists of, as indicated by how much force it takes to accelerate it. Getting a 2000-kilogram car to go from a standing start to 60 mph in 10 seconds takes twice as much engine power as getting a 1000kilogram car to get to the same speed in the same time.

Measured in kilograms [metric].

Since it is mainly scientists who make the distinction between mass and weight, there is not a commonly used non-metric unit of mass.

Weight

is the amount of gravitational force acting on an object. At any specific location, the weights of objects are proportional to their masses; gravity is acting on the same property of objects that resists changes in their motion. As gravity differs depending on where you are, weight is not an intrinsic attribute of objects in the way that mass is.

Measured in units of force: *newtons* [metric] or *pounds* [non-metric].

One newton equals about 0.225 pounds.

Almost all human activity is on or near the Earth's surface, so in everyday speech we often describe how much mass something has by saying how much it weighs ("that sewing machine contains 12 pounds of iron") or describe how much something weighs by stating its mass ("that bridge can support a 5000-kilogram truck"). Sometimes it is even said (incorrectly) that 1 kilogram *equals* 2.2 pounds, although kilograms measure mass and pounds measure force. The correct full statement would be "Near the Earth's surface, 1 kilogram *weighs* 2.2 pounds."

But even near the Earth's surface, there are small variations in the strength of gravity that can make the weights of objects vary by almost 1%. This variation can come in handy! One way of finding where to drill oil wells, for example, takes advantage of weight differences. The lower density of oil compared to water or rock means that gravity is slightly weaker over an oil field. The devices used for these measurements are so sensitive that they can show that gravity is weaker on the roof of a building than on the ground floor, due to the greater distance from the center of the Earth.

The really significant differences between mass and weight show up in space. People who weigh 150 pounds on Earth would weigh about 25 pounds on the Moon, even though their mass would be the same. A ball floating in the space station is in free fall and has no apparent weight, but still has the same mass and is just as hard to throw as on Earth.

Keeping track of the difference between mass and weight is easier when the metric system is used, so computations involving mass are often done in metric units and then converted back to other units if necessary.

