Falling Bodies, Laws of

How to Cite This Article

A falling body is an unsupported object that is being pulled toward the Earth's surface by the force of gravity. The motion of falling bodies is governed by several laws.

Gravity is the Earth's force of attraction, and it continually pulls on all objects. We can observe its effects every day: Leaves, raindrops, snowflakes, and meteors are all falling bodies. Hold a ball in your upturned palm. Gravity is pulling the ball toward the Earth. But the ball does not fall, because it is supported by your hand. Now turn your hand over. The ball is no longer supported by your hand, and it falls toward the ground.

The Italian scientist Galileo was the first to set forth the laws governing falling bodies, in 1604. Galileo experimented with falling bodies in his laboratory and found that objects of varying weights reached the ground at about the same time when dropped from the same height. As a result, he concluded that under the influence of gravity alone, all bodies fall at the same rate, regardless of their weights.

But when objects fall through the air, they are influenced by more than gravity—the air exerts resistance on them. A feather falls more slowly than a stone because the air slows down the flat, light feather more than it slows the round, heavy stone. The greater the surface area of an object, the more air resistance it encounters. A sheet of paper is slowed more than a pea that has the same weight as the paper.

When there is no air resistance, all objects fall at the same rate. This was proved after the invention of the air pump about 1650. A feather and a coin were placed inside an enclosed glass tube about 3 feet (1 meter) long. The tube was turned upside down and, as expected, the coin fell faster than the feather. Next, most of the air was pumped out of the tube, and the experiment was repeated. Without air resistance, the coin and the feather fell at the same rate, landing at the bottom of the tube at the same time.

The speed, or **velocity**, of a falling body increases in proportion to the time spent falling. The longer a body falls, the faster and faster it moves. Anything that picks up speed is said to **accelerate**. A freely falling body has an acceleration of 32 feet (9.8 meters) per second during each second it falls. That is, for each second a body falls, it gains that much in downward speed. A falling body has a speed of 32 feet per second after falling exactly one second. Its speed is 32 plus 32, or 64 feet a second after falling for 2 seconds, and so on.

However, a body falling through the air does not continue to gain speed at this rate. Instead, it reaches a certain top speed. Because of air resistance, there is a limit to how fast an object falls. It accelerates as it begins to fall, but air resistance builds up. At a certain point, the air resistance becomes equal to the pull of gravity on the object. Then the object can fall no faster. It has reached its final speed, or **terminal velocity**, and it keeps this speed as it continues to fall. This is true of even the heaviest objects. But a heavy object falls more quickly through air than a lighter object because it will accelerate to higher speeds before encountering enough air resistance to balance the force of gravity.

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See also: Galileo; Gravity and Gravitation.

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