

## Acceleration

This sprinter is picking up speed and over the course of the race will increase that speed until the finish line is crossed. This constant change of speed is known as acceleration. But more than just a change in speed, acceleration also takes into account any change in direction of an object in motion. So acceleration really focuses on a change in velocity.

Thus if a driver slows the car to make a turn, scientists would still say the acceleration of the vehicle has changed because of the change in direction and thus velocity. Scientists define acceleration, then, as a rate of change and velocity.

To calculate the acceleration of an object, we can use the following formula. Acceleration equals the final velocity minus the starting velocity divided by the time it takes to change the velocity. For example, take a look at a runner in this race. Five seconds after the start of the race, the runner has a velocity of 15 meters per second. What do you think is his acceleration?

To get our answer, we calculate the following. The final velocity is 15 meters per second, minus the starting velocity, which is 0 meters per second, divided by the time, 5 seconds, that it takes to change the velocity. This gives the answer that the runner's acceleration is 3 meters per second. In this problem, the starting velocity was 0 and then, of course, it increased. Scientists call such an increase in velocity positive acceleration.

Notice this plane landing. As it approaches, its velocity gradually becomes less. When velocity decreases like this, the formula for figuring acceleration has a result that shows negative acceleration, which is referred to simply as deceleration.

Now consider this problem and decide whether it's an example of acceleration or deceleration. A cross-country runner passing point a on a flat stretch is jogging at 4 meters per second. But, very shortly, the runner comes to a hill, with the result that after 30 seconds at point b, the velocity has dropped to 2 meters per second. What then was the jogger's acceleration between points a and b? We'll use the formula for acceleration to find an answer.

As you probably remember, the equation states that acceleration equals the final velocity minus the starting velocity divided by the time it takes to change that velocity. So, plugging into the formula, we have the final velocity, 2 meters per second, minus the starting velocity, 4 meters per second, divided by the running time, 30 seconds. The answer is minus 0.06 meters per second. So the runner is decelerating.

Look at the passengers on this Ferris wheel. Do you think they're accelerating or decelerating? The passengers on the Ferris wheel are accelerating. Because physicists say that objects traveling in a circular motion are experiencing a constant change in direction, or velocity, and are thus accelerating. This is true even if their speed is constant.

Centripetal acceleration is the term used by scientists for acceleration that occurs in a circular motion. In our daily lives we encounter circular motion in many activities, such as vehicles turning a corner or people running or bicycling on a curved track. In all of these cases, objects are changing

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direction and thus their velocity. So they are accelerating. Indeed, our planet is rotating constantly. So in a sense, all of us are in a continuous state of acceleration.

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