

Newton's Laws of Motion : Notes-02

We have studied **kinematics**, which is the study of how things move. Much of this science was discovered by Galileo. **Dynamics** is the study of why things move the way that they do. Much of this science was discovered by Sir Isaac Newton. He discovered the Law of Universal Gravitation which required the concept of the force. He also discovered the three laws of motion. He found that with his laws, he could explain the motion of most bodies and all of kinematics.

Newton's Three Laws of Motion

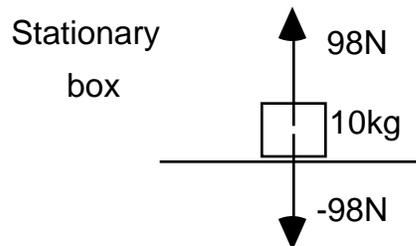
- 1) A body will tend to remain at rest or move in a straight line at a constant speed if the net force (total force) on it is zero. This law is sometimes called the law of inertia.
- 2) The net force on a body is equal to the mass of the object multiplied by the acceleration of the body. This is a definition of a force. Mathematically this law may be written as;

$$F_{\text{net}} = m \cdot a$$

- 3) For every action, there is an equal and opposite reaction.

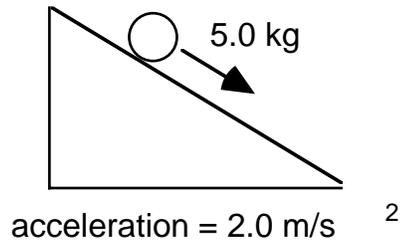
The best way to learn how to use these laws is to look at many simple examples.

Examples:



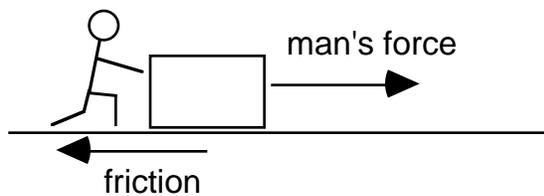
The weight of the box = -98N. The normal force = +98N. The net force is zero. By Newton's first law, the object remains at rest.

Ball rolls
down
incline



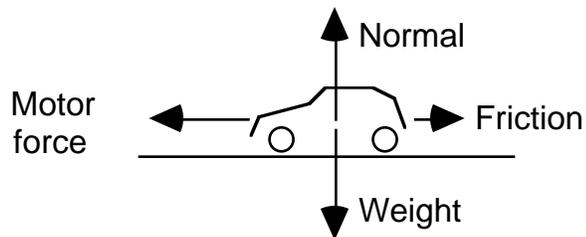
The mass of the ball is 5.0 kg. The acceleration is 2.0 m/s². By Newton's second law, the net force on the object is 10. N. (friction is zero)

Man pushes box at constant speed

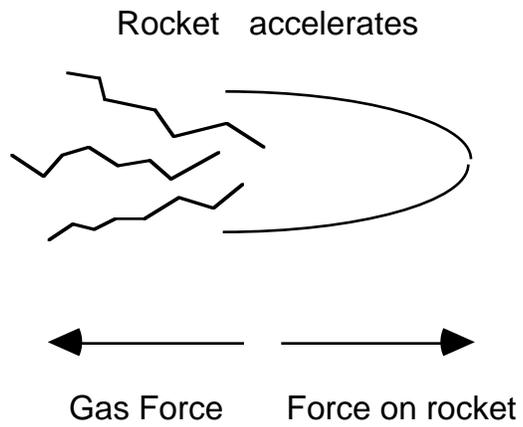


The man's force is equal and opposite to the force of friction. The net force is zero. By Newton's first law the box moves at a constant speed in a straight line.

Car accelerates left



The net force on the car is not zero. By Newton's second law, the car will accelerate to the left.



The burning gases accelerate out of the back of the rocket. By Newton's third law, the force on the rocket is equal but opposite to the force on the gases.