# Momentum | Impulse and Newton's Second Law of Motion in Term of Momentum

The momentum is the physical quantity, which determines how easy or difficult it is to stop a moving body. If the body is massive or moving very fast it is difficult to stop it.

## Topic Related Video:

## Introduction to momentum in physics

This quality of the moving body was called the quantity of motion of the body. The linear momentum of the body is defined as

***"The product of mass and velocity of the body". It is denoted by P.***

Let "m" be the mass of the body moving with velocity v. Then

$$P = mv$$

Since velocity is a vector quantity, so momentum is also a vector quantity.

## Unit and dimension of momentum

The SI unit of momentum is (Kg m $s^{-1}$) or Ns.

$$F=ma$$

$$N=Kgms^{-2}$$

$$Ns=Kgms^{-1}$$

It has dimension of **$[MLT^{-1}]$**

## Newton's Second Law of Motion in Term of Momentum

"The rate of change of momentum is equal to athe pplied force and change of momentum takes place in the direction of applied force".

Consider a body of mass "m" moving with velocity v. Let an external force "F" acts on the body for time t. Its velocity becomes v.

Then the acceleration produce in the body is

$$a= v_f-v_i/t$$

**By Newton second law**

$$F= ma$$

Using the value of "a"

$$F=m (v_f-v_i/t)$$

$$Fxt=m (v_f-v_i)$$

$$Fxt= mv_f -mv_i$$

$$Fxt=P_f - P_i$$

$$Fxt = \Delta P$$

$$F= \Delta P/ t$$

"The force applied on the body is equal to the rate of change of momentum". It proves the second law in terms of linear momentum.

# What is Impulse?

***"When a force acts on a body for a very short time, the product of the force and the time for which the force acts is called the impulse."***

**Example**:

when a bat hits the cricket ball.

# Impulsive Force:

"A large force which acts on a body for a very short interval of time is called impulsive force."

The exact value of impulsive force cannot be determined because it does not remain constant.

**Impulse =I = F x Δt**

It is a **vector quantity**. Its unit is Ns or ($Kgms^1$).

# Impulse is Equal to Change in Momentum:

According to Newton's second law of motion, the force is equal to the rate of change of momentum.

$$F=\Delta p/\Delta t$$

$$F x \Delta t = \Delta P$$

The product (Fx At) is called impulse denoted by I

$$I= \Delta P$$

Hence the impulse is equal to a change in momentum.