

{ B.Sc. Physics (Hons) Part II  
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(1)

Q What do you understand by the inertial frame of reference?

Ans :-

Newton's first law of inertia states that the body at rest remains at rest and body in motion continues in motion unless an external force is applied to it.

The above statement have no meaning unless it is described with respect to some well defined co-ordinate system or frame of reference related to which the velocity of that body is measured. This led ~~to~~ Newton to introduce the idea of absolute space which represents the system of reference relation to which the motion of the body can be defined. This created the problem to find the system of reference in such a way that the law of nature become simple when they are expressed in terms of such frame of reference.

There are two types of frame of reference :-

- (i) Accelerated frame of reference
- (ii) unaccelerated frame of reference

we have to choose unaccelerated frame of reference because in this case laws of mechanics preserve the same form when they are expressed in term of any of these frame of reference.

Let the frame are moving with uniform velocity having co-ordinate of the body in motion are  $x, y, z$ . The co-ordinate

$x, y, z$  are function of time  $t$ . Since the body is not affected by any force i.e. it is moving with constant velocity.

$$\left. \begin{aligned} \frac{d^2x}{dt^2} = 0, \quad \frac{d^2y}{dt^2} = 0, \quad \frac{d^2z}{dt^2} = 0 \\ \text{or } \frac{dx}{dt} = u, \quad \frac{dy}{dt} = v, \quad \frac{dz}{dt} = w \end{aligned} \right\}$$

Here  $u, v$  &  $w$  being velocity components in  $x, y$  &  $z$  direction respectively. This is Newton's first law of motion, inertia.

Such co-ordinate system is called 'inertial frame'. Thus an inertial frame of reference is one in which Newton's first law of motion hold good.