

Date:- 24/10/2024. (1.)

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FRIMJC SEM-IUnit - IV

* Frame of reference :- To study the collision between two particles we need a frame of reference. There are two types of reference frame or system.

1. Lab system or laboratory frame of reference.
2. Centre of mass system or frame of reference.

* Laboratory frame

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If the origin of the reference system is a point rigidly fixed to the laboratory then the system is called laboratory system or frame of reference.

* Centre of mass frame or system

If the origin of the reference frame is a point fixed rigidly to the centre of mass of a system of particles on which no external force is acting is called centre of mass system or frame of reference.

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In the centre of mass frame of reference the position vector of the centre of mass is $\vec{R} = 0$ as the centre of mass itself is origin of the reference system.

∴ The velocity of the centre of mass

$$\frac{d\vec{R}}{dt} = 0 \cdot \vec{v}$$

∴ The Linear momentum of the system

$$\vec{p} = m\vec{v} = 0.$$

Hence it is known as zero momentum

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frame. In absence of any external force the velocity of the centre of mass is constant. So centre of mass frame moves with a constant velocity with respect to laboratory frame. Hence centre of mass frame of reference is an inertial frame.

Q.1 What is the difference between Lab frame and centre of mass frame?

Q.2. Why is centre of mass frame of reference called an inertial frame?