**AIM**

To study the variation of mass with velocity.

**THEORY**

In relativistic mechanics the mass of a body is not a consistent property, but it is a function of velocity of the body. Thus, the change of mass with velocity will obviously change the momentum, energy and force.

S Y’ S’ m1, u’ m2, -u’ y

v O O’ X-X’ Z Z’

Let us consider two inertial frame of references S and S’. Frame S is at rest while S’ is moving with constant velocity v along the x-direction. Let us assume that two bodies of masses m1 and m2 are moving towards with velocities u’ and –u’ in the moving frame S’ and velocities observed by an observer in S are u1 and u2.

After collision colliding masses are momentarily at rest and they move with frames’s velocity v. According to velocity addition theorem we have,

and

Using Law of conservation of momentum in S frame,

Substituting values of and , we obtain,

We can find values of

From here,

Similarly, we can obtain

If mass in the system S is at rest before collision, its velocity , then

or

If , then above equ. reduces to

As it is practically impossible. It confirms that no material particle can go with or faster than velocity of light.

PRETEST

1. Calculate the velocity of a particle at which its mass will be 3 times of its rest mass.

2. Differentiate between effective mass and rest mass.

3. A particle is moving with 30% of the velocity of light. Compare its relativistic mass with its rest mass.

PITFALL

If a particle moves with velocity of light, what will be effect on its relativistic mass? Its relativistic mass becomes infinite,

a) Yes

b) No

PROCEDURE

1. Select two inertial frames S and S’.

2. S is at rest and S’ moves with constant velocity v along + x axis.

3. Consider two massive bodies in S’ frame (moving towards with each other with same velocities).

PROTEST

1. A particle is accelerated to a speed of .95c relative to an observer in a laboratory, the "lab" frame. If the particle was originally measured to have a mass of 5 grams, what is the mass that is observed in the laboratory?

ANS- m = 16 g

REFERENCES

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