QUES 09

A ball is bouncing elastically with a speed 1 m/s between walls of a railway compartment of size 10 m in a direction perpendicular to the walls. The train is moving at a constant velocity of 10 m/s parallel to the direction of motion of the ball. As seen from the ground,
(a) the direction of motion of the ball changes every 10 seconds.
(b) speed of ball changes every 10 seconds.
(c) average speed of ball over any 20 second interval is fixed.

(d) the acceleration of ball is the same as from the train.
Sol: (b, c, d) In this problem, we have to observe the motion from different frames. Here the problem can be solved by the frame of the observer but here we must be clear that we are considering the motion from the ground so we just keep in mind the motion from frame of observer. Compared to the velocity of trains (10 m/s) speed of ball is less (1 m/s). (b, c, d) In this problem, we have to observe the motion from different frames. Here the problem can be solved by the frame of the observer but here we must be clear that we are considering the motion from the ground so we just keep in mind the motion from frame of observer. Compared to the velocity of trains (10 m/s) speed of ball is less (1 m/s).
The speed of the ball before collision with side of train is 10 + 1 = 11 m/s Speed after collision with side of train =10-1=9 m/s As speed is changing after travelling 10 m and speed is 1 m/s, hence time duration of the changing speed is 10 s.
Since, the collision of the ball is perfectly elastic there is no dissipation of energy, hence total momentum and kinetic energy are conserved.
Since, the train is moving with a constant velocity, hence it will act as an inertial frame of reference as that of Earth and acceleration will be same in both frames.
Remember: We should not confuse with non-inertial and inertial frame of reference. A frame of reference that is not accelerating will be inertial.