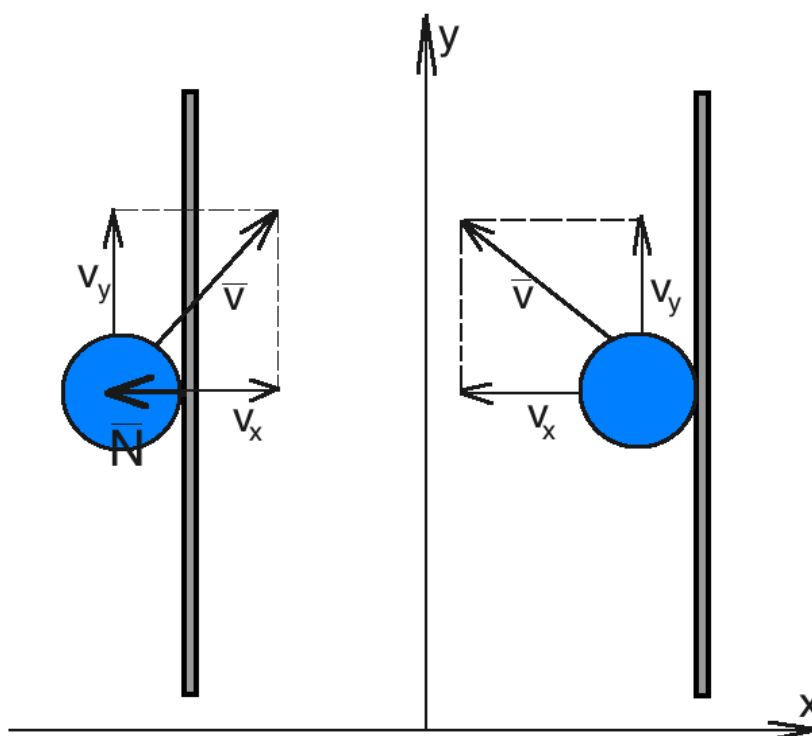


Answer on Question #40541 - Physics, Mechanics | Kinematics | Dynamics

When we throw a ball on a wall at some angle and it rebounds back with same velocity there is change in momentum. so how we can say law of conservation of momentum is obeyed there??

Solution:



In a closed system (one that does not exchange any matter with the outside and is not acted on by outside forces) the total momentum is constant.

But in our situation ball contacts with the wall (system is not closed), so the reaction force of the wall acting on the ball. Thus, we have action of force outside the system, and now the momentum is not constant(along the X-axis).

We can easily use the law of conservation of momentum along the Y-axis because reaction force acts perpendicular to wall's surface (perpendicular to the vertical axis) and does not affect the vertical momentum of the ball.

Action of the reaction force change the momentum of the ball in the opposite direction (velocity remained the same, but the direction is reversed).

We can use the law of conservation of momentum along the X-axis if we take into account the impulse that brings the wall to the system (momentum of the reaction force)

$$\text{along the X - axis: } p_{\text{before}} = p_{\text{after}} \quad (1)$$

$$p_{\text{before}} = mv_x \quad (2)$$

$$p_{\text{after}} = -mv_x + p_{\text{wall}} \quad (3)$$

(3)and(2)in(1):

$$mv_x = -mv_x + p_{\text{wall}}$$

$$p_{\text{wall}} = 2mv_x$$

Thus, the wall changes the momentum of the ball twice (changes its direction to opposite direction and gives the same speed, that was before the hit)