Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

8 Momentum

Exercise B, Question 11

Question:

A particle A, of mass 0.3 kg, is moving with velocity $\begin{bmatrix} 7 \\ 4 \end{bmatrix}$ m s^{-1} when it collides with a stationary particle, B, of mass 0.5 kg. Immediately after the collision, B moves with velocity $\begin{bmatrix} 6 \\ 0 \end{bmatrix}$ m s^{-1}.

(a) Find the velocity of A immediately after the collision.

(b) Find the speed of A immediately after the collision.

(c) State which of A and B moves faster after the collision. [A]

Solution:

(a) Let **v** be the velocity of A after the collision.
Using conservation of momentum,

$$0.3 \begin{bmatrix} 7 \\ 4 \end{bmatrix} = 0.3\mathbf{v} + 0.5 \begin{bmatrix} 6 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 2.1 \\ 1.2 \end{bmatrix} = 0.3\mathbf{v} + \begin{bmatrix} 3 \\ 0 \end{bmatrix}$$

$$0.3\mathbf{v} = \begin{bmatrix} -0.9 \\ 1.2 \end{bmatrix}$$

$$\therefore \mathbf{v} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$$

Velocity of A immediately after the collision is $\begin{bmatrix} -3 \\ 4 \end{bmatrix}$ m s^{-1}

(b) The speed of A immediately after the collision is
$\sqrt{(-3)^2 + 4^2} = 5$ m s^{-1}

(c) After the collision, the speed of B is 6 m s^{-1}

$\therefore$ B is moving faster.