Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

8 Momentum

Exercise Test yourself, Question 4

Question:

Two particles, A and B, have velocities $\begin{bmatrix} 4 \\ 7 \end{bmatrix}$ m s^{-1} and $\begin{bmatrix} -2 \\ 6 \end{bmatrix}$ m s^{-1}, respectively, when they collide. The mass of A is 4 kg and the mass of B is 6 kg.

(a) If the particles coalesce, find their velocity after the collision.

(b) If the velocity of B is $\begin{bmatrix} 0.5 \\ 4 \end{bmatrix}$ m s^{-1} after the collision, find the velocity of A.

Solution:

(a) Using conservation of momentum

$$4\begin{bmatrix} 4 \\ 7 \end{bmatrix} + 6\begin{bmatrix} -2 \\ 6 \end{bmatrix} = 10\mathbf{v}$$

$$\begin{bmatrix} 4 \\ 64 \end{bmatrix} = 10\mathbf{v}$$

$$\mathbf{v} = \begin{bmatrix} 0.4 \\ 6.4 \end{bmatrix} \text{ m s}^{-1}$$

(b) Using conservation of momentum

$$4\begin{bmatrix} 4 \\ 7 \end{bmatrix} + 6\begin{bmatrix} -2 \\ 6 \end{bmatrix} = 4\mathbf{v} + 6\begin{bmatrix} 0.5 \\ 4 \end{bmatrix}$$

$$\begin{bmatrix} 4 \\ 64 \end{bmatrix} = 4\mathbf{v} + \begin{bmatrix} 3 \\ 24 \end{bmatrix}$$

$$4\mathbf{v} = \begin{bmatrix} 1 \\ 40 \end{bmatrix}$$

$$\therefore \mathbf{v} = \begin{bmatrix} 0.25 \\ 10 \end{bmatrix} \text{ m s}^{-1}$$