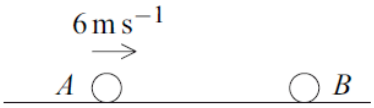
Mechanics 1 Momentum Questions

1 A particle A moves across a smooth horizontal surface in a straight line. The particle A has mass 2 kg and speed $6\,\text{m s}^{-1}$. A particle B, which has mass 3 kg, is at rest on the surface. The particle A collides with the particle B.



(a) If, after the collision, A is at rest and B moves away from A, find the speed of B. *(3 marks)*

(b) If, after the collision, A and B move away from each other with speeds $v\,\text{m s}^{-1}$ and $4v\,\text{m s}^{-1}$ respectively, as shown in the diagram below, find the value of v.

(3 marks)

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8 Two particles, A and B, are moving on a smooth horizontal surface.

The particle A has mass m kg and is moving with velocity $\begin{bmatrix} 5 \\ -3 \end{bmatrix}\,\text{m s}^{-1}$.

The particle B has mass 0.2 kg and is moving with velocity $\begin{bmatrix} 2 \\ 3 \end{bmatrix}\,\text{m s}^{-1}$.

(a) Find, in terms of m, an expression for the total momentum of the particles. *(2 marks)*

(b) The particles A and B collide and form a single particle C, which moves with velocity $\begin{bmatrix} k \\ 1 \end{bmatrix}\,\text{m s}^{-1}$, where k is a constant.

(i) Show that $m = 0.1$. *(3 marks)*

(ii) Find the value of k. *(3 marks)*

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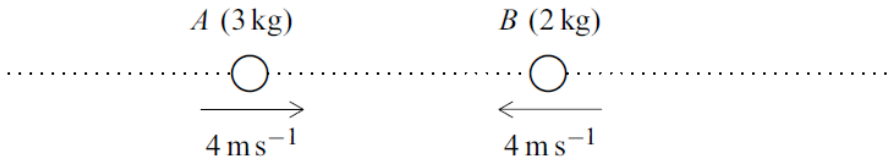
1 Two particles A and B have masses of 3 kg and 2 kg respectively. They are moving along a straight horizontal line towards each other. Each particle is moving with a speed of $4\,\text{m s}^{-1}$ when they collide.



(a) If the particles coalesce during the collision to form a single particle, find the speed of the combined particle after the collision. *(3 marks)*

(b) If, after the collision, A moves in the same direction as before the collision with speed $0.4\,\text{m s}^{-1}$, find the speed of B after the collision. *(3 marks)*

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2 Two particles, A and B, are moving on a smooth horizontal surface. Particle A has mass 2 kg and velocity $\begin{bmatrix} 3 \\ -2 \end{bmatrix}\,\text{m s}^{-1}$. Particle B has mass 3 kg and velocity $\begin{bmatrix} -4 \\ 1 \end{bmatrix}\,\text{m s}^{-1}$. The two particles collide, and they coalesce during the collision.

(a) Find the velocity of the combined particles after the collision. *(3 marks)*

(b) Find the speed of the combined particles after the collision. *(2 marks)*
