

Solutions

Each answer shows the steps, then the **result**.

2.1

- $0 \leq e \leq 1$

2.2

- separation = $e \times$ approach = $0.25 \times 8 = 2 \text{ m s}^{-1}$

3.1 C

- A perfectly elastic collision has $e = 1$

3.2

(a)

- take P 's direction positive: momentum $3(4) + 1(-2) = 3v_P + 1v_Q$, i.e. $3v_P + v_Q = 10$;
restitution $v_Q - v_P = 0.5(4 - (-2)) = 3$

(b)

- from the two equations: $v_Q = v_P + 3$; $3v_P + v_P + 3 = 10 \Rightarrow 4v_P = 7 \Rightarrow v_P = 1.75 \text{ m s}^{-1}$;
 $v_Q = 4.75 \text{ m s}^{-1}$

3.3

- speed hitting floor: $v = \sqrt{2g(2)} = \sqrt{40} = 6.32 \text{ m s}^{-1}$; rebound speed = $ev = 0.8(6.32) = 5.06 \text{ m s}^{-1}$; bounce height = $\frac{(ev)^2}{2g} = \frac{25.6}{20} = 1.28 \text{ m}$