

Question	Answer	Marks	Guidance
(a)	$0.4 \times 3 + 0.2 \times 2 = 0.4 \times 2.5 + 0.2v$	<b>M1</b>	Use of conservation of momentum with 4 terms. Allow sign errors.
	$v = 3 \text{ ms}^{-1}$	<b>A1</b>	Allow M1A0 if g included with the masses.
		<b>2</b>	
(b)	For $A$ $\pm 0.4g \sin 30^\circ = 0.4a$ or for $B$ $\pm 0.2g \sin 30^\circ = 0.2a$ or $\pm mg \sin 30^\circ = ma$	<b>M1</b>	For either. Allow sin/cos mix.
	$a = \pm 5$ or $\pm g \sin 30^\circ$	<b>A1</b>	Allow $g \sin 30^\circ$ without working for M1A1
	For $B$ when hits barrier $v^2 = 3^2 + 2 \times 5 \times 1.6 \Rightarrow v = 5$ OR $v = u + at \Rightarrow v = 3 + 5 \times 0.4 \Rightarrow v = 5$	<b>M1</b>	Using <i>their</i> $a \neq \pm g$ and <i>their</i> $v$ from part (a) OR: use of $s = \frac{u+v}{2}t$ $1.6 = \frac{3+v}{2} \times 0.4 \Rightarrow v = 5$ OR $\frac{1}{2} \times 0.2 \times v^2 - \frac{1}{2} \times 0.2 \times 3^2 = 0.2 \times 1.6 \times g \sin 30$
	Speed after hitting barrier $= 0.1 \times 5 = 0.5$	<b>A1</b>	<b>AG</b>
	$v_A = 2.5 + 5 \times 0.44 [= 4.7]$ $v_B = -0.5 + 5 \times 0.04 [= -0.3]$ or $v_B = 0.5 + (-5) \times 0.04 [= 0.3]$	<b>*M1</b>	Use of $v = u + at$ for either with correct $t$ -value, with initial speeds $\pm 2.5$ or $\pm 0.5$ <i>their</i> $\pm a \neq \pm g$
	$0.4 \times 4.7 + 0.2 \times (-0.3) = 0.6 v_{\text{comb}}$	<b>DM1</b>	Use of $v = u + at$ for BOTH with correct $t$ -values, initial speeds $\pm 2.5, \pm 0.5$ and $\pm$ <i>their</i> acceleration (same for both) and use of conservation of momentum with correct number of terms. Allow sign errors.
	$v_{\text{comb}} = 3.03 \text{ ms}^{-1}$	<b>A1</b>	Allow $v = \frac{91}{30} = 3\frac{1}{30}$ Allow DM1A0 if g included with the masses.
		<b>7</b>	