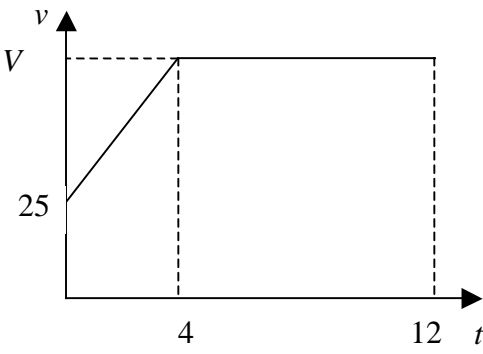
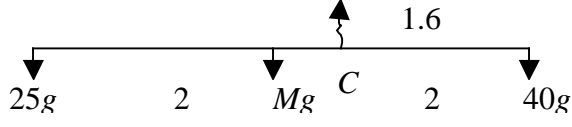
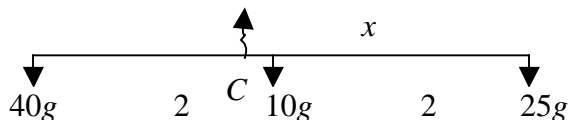
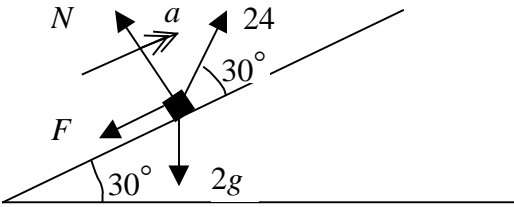
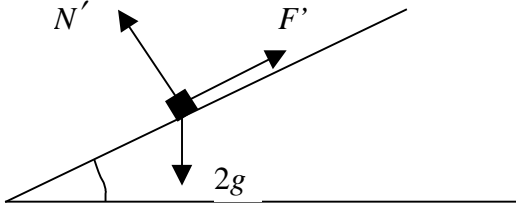


Question number	Scheme	Marks
<p>3. (a)</p>	 <p style="text-align: center;"> v V 25 t 4 12 </p>	<p>B1 (shape) B1 (figs) (2)</p>
<p>(b)</p>	$600 = 8V + \frac{1}{2}(25 + V) \cdot 4$ $\Rightarrow V = 55$	<p>M1 A1, A1 A1 (4)</p>
<p>(c)</p>	$a = \frac{55 - 25}{4} = 7.5 \text{ m s}^{-2}$	<p>M1 A1 (2)</p>
<p>4. (a)</p>	 <p style="text-align: center;"> $25g$ 2 Mg C 2 $40g$ 1.6 </p> $\text{M(C)} \quad 40g \cdot 1.6 = Mg \cdot 0.4 + 25g \cdot 2.4$ $\Rightarrow M = 10 \text{ kg}$	<p>M1 A1 A1 (3)</p>
<p>(b)</p>	 <p style="text-align: center;"> $40g$ 2 C $10g$ 2 $25g$ x </p> $\text{M(C)} \quad 25g \cdot x + 10g \cdot (x - 2) = 40g \cdot (4 - x)$ $\Rightarrow 75x = 180$ $\Rightarrow x = 2.4 \text{ m}$	<p>M1 A1 A1 M1 A1 (5)</p>

Question number	Scheme	Marks
(c)	(i) Weight acts at centre of plank (ii) Plank remains straight (iii) Weights act at the ends of the plank	B1 B1 B1 (3) (11)
5.	<p>(a) “$v^2 = u^2 + 2as$”:</p> $V^2 = 2 \cdot 9.8 \cdot 1.6$ $\Rightarrow V = 5.6 \text{ m s}^{-1}$ <p>(b)</p> $78 \cdot 5.6 = 84 \cdot v$ $\Rightarrow v = 5.2 \text{ m s}^{-1}$ <p>(c)</p> $84 \cdot 5.2 = F \cdot 0.06 - 84g \cdot 0.06$ $\Rightarrow F = 8103.2 \text{ N}$ <p>(d)</p> <p>“$F = ma$”:</p> $8103.2 - 84g = 84a \Rightarrow a = 86.67$ <p>“$v^2 = u^2 + 2as$”:</p> $5.2^2 = 2 \cdot 86.67 \cdot s$ $\Rightarrow s \approx 0.156 \text{ m, or } 0.16 \text{ m to 2 s.f.}$	M1 A1 (2) M1 A1 A1 (3) M1 A1 A1 A1 (4) M1 A1 M1 A1 (4)
6.	<p>(a) At time t</p> $\mathbf{r}_A = (-5 + 2t)\mathbf{i} + (10 + 2t)\mathbf{j}$ $\mathbf{r}_B = (3 - 2t)\mathbf{i} + (4 + 5t)\mathbf{j}$ <p>\mathbf{i} components equal when $-5 + 2t = 3 - 2t \Rightarrow t = 2 \text{ h}$</p> <p>$t = 2$: $\mathbf{r}_A = -\mathbf{i} + 14\mathbf{j}$; $\mathbf{r}_B = -\mathbf{i} + 14\mathbf{j} \Rightarrow$ collide</p> <p>(b)</p> <p>New $\mathbf{r}_A = (-5 + t)\mathbf{i} + (10 + t)\mathbf{j}$</p> $\Rightarrow AB = \mathbf{r}_B - \mathbf{r}_A = (8 - 3t)\mathbf{i} + (-6 + 4t)\mathbf{j}$ <p>(c)</p> <p>$t = 2$: $\overrightarrow{AB} = 2\mathbf{i} + 2\mathbf{j}$, \Rightarrow dist. = $\sqrt{(2^2 + 2^2)} \approx 2.83 \text{ km}$</p> <p>(d)</p> <p>$B$ north of $A \Rightarrow 8 - 3t = 0 \Rightarrow t = 8/3 \Rightarrow$ time 1440 hours</p>	B1 B1 M1 A1 M1 A1 (6) M1 A1 (2) M1 M1 A1 (3) M1 A1 (2)

Question number	Scheme	Marks
7. (a)	 <p data-bbox="332 653 816 688">R(\perp) $N + 24 \cos 60^\circ = 2g \cos 30^\circ$</p> <p data-bbox="430 741 805 772">$\Rightarrow N = 16.97 - 12 = 4.97 \text{ N}$</p> <p data-bbox="430 821 789 852">$\Rightarrow F = 0.4 \cdot 4.97 = 1.99 \text{ N}$</p> <p data-bbox="332 905 935 940">R(\parallel) $2a = 24 \cos 30^\circ - 2g \cos 60^\circ - 1.99$</p> <p data-bbox="524 989 756 1024">$\Rightarrow a \approx 4.5 \text{ m s}^{-2}$</p>	M1 A1 A1 M1 A1 M1 A1 A1 (8)
(b)	 <p data-bbox="332 1476 849 1512">R(\perp) $N' = 2g \cos 30^\circ = 16.97$</p> <p data-bbox="524 1564 948 1600">$\Rightarrow F'_{\max} = 0.4 \cdot 16.97 = 6.79 \text{ N}$</p>	M1 A1
(c)	<p data-bbox="430 1644 1149 1680">Component of weight down plane $= 2g \sin 30^\circ = 9.8 \text{ N}$</p> <p data-bbox="430 1717 1122 1753">$9.8 > F'_{\max} \Rightarrow$ net force down plane \Rightarrow parcel moves</p> <p data-bbox="430 1791 894 1827">$2f = 9.8 - 6.79, \Rightarrow f \approx 1.5 \text{ m s}^{-2}$</p>	M1 A1 (4) M1 A1, A1

