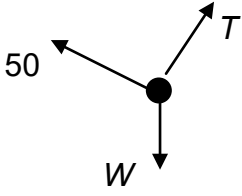


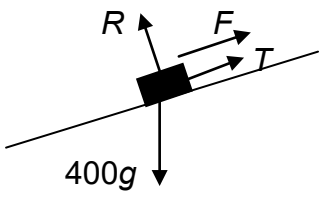


Question Number	Scheme	Marks
1	<div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <p>(a) R (\rightarrow): $T \cos 60 = 50 \cos 30$</p> <p style="text-align: center;">$T = \underline{86.6 \text{ N}}$</p> <p>(b) R ($\uparrow$): $W = 50 \sin 30 + T \cos 30$</p> <p style="text-align: center;">$= \underline{100 \text{ N}}$</p> <p>or R ($\parallel$ to BC): $W \cos 60 = 50$</p> <p style="text-align: center;">$W = \underline{100 \text{ N}}$</p> </div> </div> <p>(a) M1 for a valid equation in T only Treat use of $\tan 30/60$ (e.g. $\tan 30 = T/50$) as invalid equation unless there is a triangle of Forces</p> <p>(b) M1 for a valid equation involving W (and T if necessary) for first A1 in (i), allow for using their T (i.e. effectively f.t.)</p> <p>Accept each answer as awrt.</p>	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>A1 (3)</p>

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2	<p>(a) $v = u + at$: $9.5 = 5 + 1.5a \Rightarrow a = 3$</p> <p>Hence $v^2 = 5^2 + 2 \times 3 \times 24$</p> <p>$= 169 \Rightarrow v = \underline{13 \text{ m s}^{-1}}$ (*)</p> <p>(b) $I = mv - mu$: $-30 = 2(v - 13) \Rightarrow v = (-) 2 \text{ m s}^{-1}$</p> <p>In direction of CA (o.e.)</p> <p>(a) 2nd M1 for equation in v (and numbers) only Final A1 is cso</p> <p>(b) M1 for valid impulse = momentum change equn with 3 non-zero terms including '30' and '13' A1 for '30' and '13' with same sign A1 for direction as 'CB' or anything convincing!</p> <p>NB both A's in (b) are cao = cso!</p>	<p>M1 A1 ↓ M1</p> <p>A1 (4)</p> <p>M1 A1</p> <p>A1 (3)</p>

Question Number	Scheme	Marks
3	<p> $u \longrightarrow$ 2 kg   4 kg $v \longleftarrow$ $\longrightarrow w$ </p> <p> CLM: $2u = -2v + 4w$ Using $w = 3v$ ($\Rightarrow 2u = -2v + 12v$) and solve $\Rightarrow v = \frac{1}{5}u$ (*) </p> <p>(b) $10 = 2a \Rightarrow a = 5 \text{ m s}^{-2}$ $0 = \frac{1}{25}u^2 - 2 \times 5 \times 1.6$ $\rightarrow u = \underline{20 \text{ m s}^{-1}}$ </p> <p>(a) 1st M1 for valid CLM equn 2nd M1 for correct equn for 'v' and 'w' and solving for v or w. Final A1 is cso (dropping u and reinserting loses last A1)</p> <p>(b) Allow B1 for $a = \pm 5$ M1 for using '$v^2 = u^2 + 2as$' with $v = 0$ and with a value for a A1 f.t. on their a (provided this is not g), but signs must be correct</p> <p>SC For using u instead of u/5 ($\rightarrow u = 4$), allow M1 A0 M0.</p> <p>Energy: $\frac{1}{2} \times 2 \times (u/5)^2 = 10 \times 1.6$ M1 A1 A1 $\rightarrow u = 20$ dep M1 A1</p>	<p>M1 A1 \downarrow M1 A1 cso (4)</p> <p>B1 M1 A1√ \downarrow M1 A1 (5)</p>

Question Number	Scheme	Marks
4	<p>(a) M(D): $20g \times 1.5 + 10g \times 1 = R_B \times 3$</p> $\Rightarrow R_B = \underline{40g/3 \approx 131 \text{ or } 130 \text{ N}}$ <p><i>[NB For moments about another point, allow M1 A1 for moments equation dimensionally correct and with correct number of terms; second M1 is for complete method to find R_B.]</i></p> <p>(b) R(\uparrow): $R_D + 40g/3 = 20g + 10g$</p> $\Rightarrow R_D = \underline{50g/3 \approx 163 \text{ or } 160 \text{ N}}$ <p>or M(B): $20g \times 1.5 + 10g \times 2 = R_D \times 3$</p> $\Rightarrow R_D = \underline{50g/3 \approx 163 \text{ or } 160 \text{ N}}$ <p><i>[NB For moments about another point, allow M1 for a complete method to find R_D, A1 for a correct equation for R_D.]</i></p> <p>(c) $R_B = 0$</p> <p>M(D): $20g \times x = 10g \times 1$</p> $x = DF = \underline{0.5 \text{ m}}$ <p><i>For weight/mass confusion, A0 A0 in (a) but allow f.t. in (b) (ans $50/3 = 16.7$)</i></p> <p><i>General rule of deducting max. 1 per question for > 3 s.f</i></p> <p>(c) 2nd M1: must have correct no. of non=zero terms, and equation in x only If use value(s) of R's from (a) or (b): M0.</p>	<p>M1 A1 ↓ M1 A1 (4)</p> <p>M1 A1√ A1 (3)</p> <p>M1 A1 A1 (3)</p> <p>M1</p> <p>M1 A1 A1 (4)</p>

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5	<p>(a)</p>  <p> $R = 400g \cos 15^\circ (\approx 3786 \text{ N})$ $F = 0.2R$ used $T + 0.2R = 400g \sin 15^\circ$ $T \approx \underline{257 \text{ or } 260 \text{ N}}$ </p> <p>(b)</p> <p> $400g \sin 15^\circ - 0.2 \times 400g \cos 15^\circ = 400a$ $a = 0.643(\dots)$ $50 = \frac{1}{2} \times 0.643 \times t^2$ $t = \underline{12.5 \text{ or } 12 \text{ s}}$ </p> <p><i>General rule again about > 3 sf</i></p> <p><i>Weight/mass confusion: treat as MR [$\rightarrow T = 26.3/26$; $a = 0.0656\dots$; $t = 39(.0)$]</i></p> <p>(b) Allow $a = 0.64$</p> <p><i>(Final M1 not dependent but requires an attempt to find an a which is not assumed to be g)</i></p>	<p>B1</p> <p>B1</p> <p>M1 A1 ↓ M1 A1 (6)</p> <p>M1 A1</p> <p>A1</p> <p>M1 A1√</p> <p>A1 (6)</p>

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6	<p>(a) Direction of $\mathbf{v} = (7\mathbf{i} - 7.5\mathbf{j}) - (4\mathbf{i} - 6\mathbf{j}) = 3\mathbf{i} - 1.5\mathbf{j}$</p> $\tan \theta = \frac{1.5}{3} = 0.5 \Rightarrow \theta = 26.565\dots$ <p>Bearing = <u>117</u> (accept awrt)</p> <p>(b) $\mathbf{v} = (3\mathbf{i} - 1.5\mathbf{j}) \div \frac{3}{4} = 4\mathbf{i} - 2\mathbf{j}$</p> $\mathbf{s} = \underline{(4\mathbf{i} - 6\mathbf{j})} + t\underline{(4\mathbf{i} - 2\mathbf{j})}$ <p>(c) At 1015 $\mathbf{s} = (4\mathbf{i} - 6\mathbf{j}) + \frac{5}{4}(4\mathbf{i} - 2\mathbf{j}) (= 9\mathbf{i} - 8.5\mathbf{j})$</p> $\mathbf{m} = 0.25(p\mathbf{i} + q\mathbf{j})$ $\mathbf{s} = \mathbf{m} \Rightarrow \underline{p = 36, q = -34}$ <p>(a) <i>Forming direction for \mathbf{v} can be either way round.</i> M1 for $\tan = 'i/j'$ or $'j/i'$ A1 for 26.6 or 63.4 (awrt) from a correct direction for \mathbf{v} A1 cao</p> <p>(b) <i>Allow B1 for correct vector for \mathbf{v} wherever seen (e.g. in (a))</i></p> <p>(c) <i>line 1: or $(7\mathbf{i} - 7.5\mathbf{j}) + \frac{1}{2}(4\mathbf{i} - 2\mathbf{j}) = \dots$</i> 1st M1 allow for a valid attempt with a value of t. 2nd M1 using $\mathbf{s} = \mathbf{m}$ and equating at least one coefficient</p>	<p>M1 ↓ M1 A1</p> <p>A1 (4)</p> <p>B1</p> <p>M1 A1√ (3)</p> <p>M1 A1</p> <p>B1 ↓ M1 A1, A1 (6)</p>

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7	<p>(a) $F_1 = \frac{2}{7} \times 4g (= 11.2)$ or $F_2 = \frac{2}{7} \times 6g (= 16.8)$ B1</p> <p>System: $40 - \frac{2}{7} \times 4g - \frac{2}{7} \times 6g = 10a$ (equ in a and not T) M1 A1</p> <p>$\Rightarrow \underline{a = 1.2 \text{ m s}^{-2}}$ (*) A1 (4)</p> <p>(b) $P: T - \frac{8}{7}g = 4 \times 1.2$ or $Q: 40 - T - \frac{12}{7}g = 6 \times 1.2$ M1 A1</p> <p>$\Rightarrow T = \underline{16 \text{ N}}$ A1 (3)</p> <p>(c) Accelerations of P and Q are same B1 (1)</p> <p>(d) $v = 1.2 \times 7 = 8.4$ B1</p> <p>$P: (-) \frac{8}{7}g = 4a \Rightarrow a = (-) \frac{2}{7}g = 2.8$ M1 A1</p> <p>$0 = 8.4 - 2.8t \Rightarrow \underline{t = 3 \text{ s}}$ (*) M1 A1 (5)</p> <p>(e) $Q: 40 - \frac{12}{7}g = 6a$ ($\Rightarrow a \approx 3.867$) M1 A1</p> <p>$v = 8.4 + 3.867 \times 3 = \underline{20 \text{ m s}^{-1}}$ M1 A1 (4)</p> <p>(a) 1st A1 requires values for the F's. (Allow M1 with just 'F's)</p> <p>(b) Allow M1 A1 for one of these equations wherever seen (e.g. in (a))</p> <p>(c) extra statement about tensions being equal (with the correct ans): B0</p> <p>(d) allow verification</p> <p>No g: allow 1st M1 in each of parts (a), (b), (d), (e) as f.t. but other A's are cao</p>	