

Q1, (Jun 2005, Q4)

<p>(i) α</p> $2 = 0.8u + \frac{1}{2} a(0.8)^2$ $8 = 2u + \frac{1}{2} a2^2 \quad \text{or}$ $6 = 1.2(u + 0.8a) + \frac{1}{2} a(1.2)^2 \quad \text{or}$ $6 = 1.2(2 \times 2 \div 0.8 - u) + \frac{1}{2} a(1.2)^2$ $u = 1.5$ <p>Acceleration is 2.5 ms^{-2}</p>		<p>M1 A1 M1 A1 M1 A1 A1</p> <p style="text-align: right;">7</p>	<p>For using $s = ut + \frac{1}{2} at^2$ for the first stage</p> <p>For obtaining another equation in u and a with relevant values of velocity, displacement and time</p> <p>For eliminating a or u</p>
<p>(i) β</p> $2 = 0.8v - \frac{1}{2} a(0.8)^2$ $6 = 1.2v + \frac{1}{2} a(1.2)^2$ <p>Acceleration is 2.5 ms^{-2} ($v = 3.5$)</p> $u = 1.5$		<p>M1 A1 M1 A1 M1 A1 A1</p> <p style="text-align: right;">7</p>	<p>For using $s = vt - \frac{1}{2} at^2$ for the first stage</p> <p>For using $s = ut + \frac{1}{2} at^2$ for the second stage</p> <p>For obtaining values of a and v and using $v = u + at$ for first stage to find u</p>
<p>(i) γ</p> $2 \div 0.8 \text{ ms}^{-1} \text{ and } 6 \div 1.2 \text{ ms}^{-1}$ $= 2.5 \text{ ms}^{-1} \text{ and } 5 \text{ ms}^{-1}$ $t_1 = 0.4 \text{ and } t_2 = (0.8 +) 0.6$ $5 = 2.5 + a(1.4 - 0.4)$ <p>Acceleration is 2.5 ms^{-2}</p>		<p>M1 A1 B1 M1 A1</p>	<p>For finding average speeds in both intervals</p> <p>For finding mid-interval times</p> <p>For using $v = u + at$ between the mid-interval times</p>
	$2.5 = u + 2.5 \times 0.4 \text{ or}$ $5 = u + 2.5 \times 1.4$ $u = 1.5$	<p>M1 A1</p> <p style="text-align: right;">7</p>	<p>For using $v = u + at$ between $t = 0$ and one of the mid-interval times</p>
<p>(ii)</p>	$2.5 = 9.8 \sin \alpha$ $\alpha = 14.8^\circ$	<p>M1 A1ft</p> <p style="text-align: right;">2</p>	<p>For using $(m)a = (m)g \sin \alpha$ ft value of acceleration</p>

Q2, (Jun 2007, Q3)

(i)	$R + T\sin 72^\circ = 50g$	M1 A1 [2]	An equation with R, T and 50 in linear combination. $R + 0.951T = 50g$
(ii)	$T = 50g/\sin 72^\circ$ $T = 515$ (AG) $T = mg$ $m = 52.6$	M1 A1 B1 B1 [4]	Using $R = 0$ (may be implied) and $T\sin 72^\circ = 50(g)$ Or better Accept 52.5
(iii)	$X = T\cos 72^\circ$ $X = 159$	B1 B1 [2]	Implied by correct answer Or better

Q3, (Jun 2010, Q6)

i	$T - 0.85g \sin 30 = 0.85a$ $0.55g - T = 0.55a$ $a = 1.225/1.4$ $a = 0.875$ $T = 4.91$	B1 B1 M1 A1 A1 [5]	Either equation correct Both eqns correct and consistent 'a' direction Solves 2 sim eqn 4.908 or better – has to be positive
b	$F = 2T\cos 30$ $F = 8.5(02..)$	M1 A1ft [2]	Or Pythagoras or cosine rule $cv(4.91)x\sqrt{3}$
ii	$v^2 = 1.3^2 + 2x0.875x1.5 (=4.315)$ $a = +/-g\sin 30$ $0 = 4.315 - 2x4.9s$ $(s = 0.44...)$ $S = 1.94$	M1 A1ft B1 M1 A1 A1 [6]	Uses $v^2 = u^2 + 2a(1.5)$, u non-zero, a from (i) $v = 2.077... (v^2 = 1.69 + 3xcv(0.875))$ $a = +/-4.9$ Uses $0^2 = u^2 +/- 2as$, with a not g or (i), u not 1.3 May be implied – need not be 3sf

Q4, (Jan 2006, Q6)

(i)	$T_A \cos \alpha - T_B \cos \beta = W$ $T_A = T_B (= T)$ $\cos \alpha > \cos \beta \Rightarrow \alpha < \beta$	M1 B1 A1 [3]	For resolving 3 forces vertically, condone Wg , sin May be implied or shown in diagram AG
(ii)(a)	$T \sin \alpha + T \sin \beta = 14$ $\sin \alpha = 0.6$ and $\sin \beta = 0.8$ Tension is 10 N	M1 DM1 A1 [3]	Resolve 3 forces horiz accept cos
(ii)(b)	$10 \cos \alpha - 10 \cos \beta = W$ $\alpha = 36.9^\circ, \beta = 53.1^\circ$ $W = 2$ <u>See appendix for solution based on resolving along RA and RB.</u>	M1 DM1 A1 ft [3]	Must use cv T, and W (not Wg) Or $\cos \alpha = 0.8$ and $\cos \beta = 0.6$ SR -1 for assuming $\alpha + \beta = 90^\circ$ ft for $T/5$ (accept 1.99)
(iii)	R is below B Tension is 1 N	B1 B1 ft [2]	Accept R more than 0.5 m below A ft for $W/2$ accept $W/2$

Q5, (Jun 2011, Q6)

i		“...smooth ring...”, “..no friction at ring..”	B1 [1]	If a variety of reasons is offered, “smooth ring” must be the last
ii		$T\cos\theta + 5 = T\cos(90-\theta)$ $T\cos\theta + 5 = T\sin\theta$(a) $T\sin\theta + T\sin(90-\theta) = 7$ $T\sin\theta + T\cos\theta = 7$ (b)	M1 A1 M1 A1 [4]	“Resolves horiz” equation, needs TCorS θ , 3 terms, 2 of which are T resolved “Resolves vert” equation, needs TCorS θ , 3 terms, 2 of which are T resolved {Allow candidates solving for (iii) to begin in (ii)}
iii		uses (b)+(a) and (b)-(a) for example $T\sin\theta = 6$ or $2T\sin\theta = 12$, $T\cos\theta = 1$ or $2T\cos\theta = 2$ $T^2 = 6^2 + 1^{(2)}$ $T = 6.08$ N $\tan\theta = 6/1$ $\theta = 80.5^\circ$ <i>OR</i> (b) gives $T=7/(\sin\theta+\cos\theta)$, subs in (a) for example $12\cos\theta = 2\sin\theta$ then mark as 6(iii) below for D*M1 A1 D*M1 A1	M1* A1 D*M1 A1 D*M1 A1 [6] M1* A1	Attempts to solve 2 equations in 2 unknowns Both terms have values correct Accept $\sqrt{37}$, 6.1 Uses a correct trig identity Accept 81° , 1.4 rad, 1.41 rad Attempts to solve 2 equations in 2 unknowns Correct two term equation in one variable

Q6, (Jan 2013, Q3)

(i)	$T \cos 20 = 0.25g \cos 30$ $T \cos 20 = 0.25g \sin 30$ $T = 1.3(0)$	M1 A1 A1 [3]	Equates cmpt T and cmpt wt // plane (doubt, see diagram and/or (ii)) 1.225
(ii)	$R \pm T \cos 20 = \pm 0.25g \cos 30$ $R + 1.3 \sin 20 = 0.25g \cos 30$ $R = 1.68 \text{ N}$	M1 A1 ft A1 [3]	Resolves perp plane, accept letter T ft(cv(T))
(iii)	$(m) \text{ accn} = \pm 9.8 \sin 30$ $a = \pm 4.9$ $u = \pm 9.8 \sin 30 \times 0.4$ $u = 1.96$	M1* A1 D*M1 A1 [4]	N2L with single force a cmpt wt (accept cos) Must be +ve (accept loss of - sign)

Q7, (Jun 2016, Q2)

i	$6.4 = (u+5)/2 \times 1.6$ $u = 3 \text{ m s}^{-1}$ $5 = 3 + 1.6a$ $a = 1.25 \text{ m s}^{-2}$ OR $6.4 = 5 \times 1.6 - a \times 1.6^2 / 2$ $a = 1.25 \text{ m s}^{-2}$ $5 = u + 1.25 \times 1.6$ $u = 3 \text{ m s}^{-1}$	M1 A1 A1 M1 A1 [5] M1 A1 M1 A1 A1	Uses $s = (u+v)t/2$ or a combination of two other formulae $5^2 = u^2 + 2 \times 6.4a$ M1 $5 = u + 1.6a$ M1 Accurate equation in one variable A1 $u = 3 \text{ m s}^{-1}$ A1 $a = 1.25 \text{ m s}^{-2}$ A1 Candidates may find a first (see below) $s = vt \pm at^2 / 2$ Must be from $s = vt - at^2 / 2$ SC Do not accept $a = 1.25$ from $6.4 = 5 \times 1.6 + a \times 1.6^2 / 2$ but allow subsequent use of $a = 1.25$ in $5 = u + 1.25 \times 1.6$
ii	$1.25(m) = (m)g \cos \theta$ $1.25(m) = (m)g \cos \theta$ OR $1.25(m) = (m)g \sin \theta$ Angle with vertical = 82.7°	M1 A1 ✓ A1 [3]	Resolves g or weight, $a \neq g$ ft cv(1.25) from (i) Must be angle with vertical

