Question	Answer	Marks	Guidance
6(a)	$R = 5g$, $F = 6g - 4g$	M1	For resolving forces to find F and R.
	$\mu = \frac{2g}{5g} = 0.4$	A1	AG
		2	
6(b)	$T_1 - 4g = 4a$ or $8g - T_2 = 8a$	M1	For applying Newton's 2nd law to the 4 kg particle or the 8 kg particle.
	$T_1 - 4g = 4a$ and $8g - T_2 = 8a$	A1	Both equations correct.
	$T_2 - T_1 - F = 5a$ and $F = 0.4 \times 5g$	B1	
	Adding gives $8g - 4g - 2g = 17a$ leading to $a = \ldots$.	M1	Attempt to solve for a, T_1 or T_2.
	$a = 1.18\,\text{ms}^{-2}$, $T_1 = 44.7$ N, $T_2 = 70.6$ N	A1	
		5	
6(c)	$T - 4g = 4a$, $-T - F = 5a$, $F = 2g$ or $-4g - 2g = 9a$	M1	Applying Newton's 2nd law to both active particles.
	$a = -\frac{60}{9}$	A1	
	$v^2 = 2 \times \frac{20}{17} \times 0.5 = \frac{20}{17}$ leading to $v = \ldots$ [$v = 1.0846\ldots$]	M1	Use of $v^2 = u^2 + 2as$ or equivalent to find v or v^2 when the 8 kg particle reaches the ground.
	$0 = \sqrt{\frac{20}{17}} - \frac{60}{9}t$	M1	Use of $v = u + at$ or equivalent to find t.
	$t = 0.163$ s	A1	From $t = 0.1626978\ldots$
		5	

Question	Answer	Marks
7(a)	$T - 2mg = 0$	B1
	$3mg \sin\theta - T = 0$ (M1 for resolving forces parallel to the plane and solving for θ)	M1
	$\theta = 41.8$ (41.810...)	A1
		3
7(b)	$R = 3mg\cos 30$	B1
	Use of $F = \mu R$	M1
	$2mg - T = 0.1 \times 2m$ OR $T - 3mg\sin 30 - \mu \times 3mg\cos 30 = 0.1 \times 3m$	M1
	$2mg - 0.2m - 3mg\sin 30 - \mu \times 3mg\cos 30 = 0.1 \times 3m$	M1
	$\mu = \frac{\sqrt{3}}{10}$	A1
		5
7(c)	$v^2 = 0 + 2 \times 0.1 \times 0.8$ $(v = 0.4)$	M1
	$-3mg\sin 30 - \mu \times 3mg\cos 30 = 3ma$ $(a = -6.5)$	M1
	$0 = -0.4 - 6.5t$	M1
	$t = 0.4/6.5 = 0.0615$ s	A1
		4

Question	Answer	Marks	Guidance
3	$T\cos 25 = 40 + R\cos 50$	M1	Resolving in any direction e.g. horizontal, vertical, along radius or tangent.
	$R\sin 50 = T\sin 25$	M1	Resolving in a second direction.
	Radially: $T\cos 25 = R + 40\cos 50$ Tangentially: $T\sin 25 = 40\sin 50$ Parallel to T: $T = R\cos 25 + 40\cos 25$ Perpendicular to T: $R\sin 25 = 40\sin 25$ Vertically: $T\cos 25 = 40 + R\cos 50$ Horizontally: $R\sin 50 = T\sin 25$	A1	Two correct equations.
	Solving equation(s) to find either T or R	M1	
	$T = 72.5$ N	A1	From 72.504….
	$R = 40$ N	A1	
		6	

Question	Answer	Marks	Guidance
4(b)	$T_A \times 0.6 - 10g = 0 \Rightarrow T_A = \frac{500}{3}$	B1	From using $T_B = 0$
	$T_A \times 0.8 - F = 0$	M1	
	$F = \frac{400}{3}$	A1	Allow $F = 133$ to 3 s.f.
		3	

Question	Answer	Marks	Guidance
5(a)	$F - 30 = 70 \times 0.3$	M1	Use of Newton's Second law
	$P = 4F$	B1	Using $P = Fv$
	$[= 51 \times 4] = 204$ W	A1	
		3	
5(b)	Change in KE $= \frac{1}{2} \times 70 \times 12^2 - \frac{1}{2} \times 70 \times 6^2$	M1	
	3780 J	A1	
		2	
5(c)	For work energy equation	M1	
	$70g \times d \sin 5 - 30d = 3780$	A1 FT	FT change in kinetic energy from **(b)**
	$d = 122$	A1	
		3	

Question	Answer	Marks	Guidance
3	$F \sin\theta + 20\sin 60 - 30\sin\alpha - 40\sin\beta = 0$	M1	For resolving in either direction
	Vertical: $F \sin\theta + 20\sin 60 - 30 \times 0.28 - 40 \times 0.6 = 0$ $[F\sin\theta = 15.07949\ldots]$	A1	
	Horizontal: $F\cos\theta + 40 \times 0.8 - 30 \times 0.96 - 20\cos 60 = 0$ $[F\cos\theta = 6.8]$	A1	
	$\theta = \tan^{-1}\dfrac{15.0794\ldots}{6.8}$	M1	For method for finding θ
	$F = \sqrt{15.07949\ldots^2 + 6.8^2}$	M1	For method for finding F
	$\theta = 65.7$, $F = 16.5$	A1	
		6	

Question	Answer	Marks	Guidance
4(a)	$24 = u \times 2 - \frac{1}{2}g \times 2^2$	M1	Use of $s = ut + \frac{1}{2}at^2$
	$u = 22$	A1	AG
		2	