1	[$0.4g - T = 0.4a$ $T = 0.6a$ System equation $0.4g = (0.4 + 0.6)a$]	M1		For applying Newton's 2nd law to either particle or to the system
		M1		For applying Newton's 2nd law to the other particle and attempt to solve for a and T
	$a = 4\,\text{m s}^{-2}$	A1		
	$T = 2.4\,\text{N}$	A1	[4]	
2 (i)	$2 = 5a \rightarrow a = 0.4\text{ ms}^{-2}$	B1		
	[$0.1g\sin20 - F = 0.1 \times 0.4$]	M1		For applying Newton's 2nd law to the particle
	$F = 0.302\,\text{N}$ AG	A1	[3]	
(ii)	[$R = 0.1g\cos20$ (= 0.9397)]	M1		For attempting to find R and using $\mu = F/R$
	$\mu = 0.3020/0.9397 = 0.321$	A1	[2]	
3 (i)	[$0 = 6^2 - 2g \times s$]	M1		For using $v^2 = u^2 + 2as$
	$s = 1.8$	A1		
	Total height = 2.3 m	B1	[3]	
	Alternative for 3(i)			
	[$6^2 = u^2 - 2g \times 0.5$]	M1		For using $v^2 = u^2 + 2as$ to find the initial velocity
	$u^2 = 46$	A1		
	$0^2 = 46 - 2gs \rightarrow s$ = total height = 2.3 m	B1	[3]	

(ii)	$[2.3 = 0 + 0.5gt^2]$	M1		For using $s = ut + 0.5gt^2$ to find time to reach the ground
	$t = 0.678$	A1		
	Total time = 2 × 0.678 = 1.36 s	B1	[3]	
	Alternative for 3(ii)			
	$[\,0 = \sqrt{46} - gt\,]$	M1		Using $v = u - gt$ to find time taken to the highest point
	$t = \dfrac{\sqrt{46}}{10} = 0.678$	A1		
	Total time = 2 × 0.678 = 1.36 s	B1	[3]	
4		M1		For resolving forces horizontally
	$2F + F\cos 60 = 15\cos\alpha$	A1		
		M1		For resolving forces vertically
	$F\sin 60 = 15\sin\alpha$	A1		
		M1		For using Pythagoras or for using tan α to find F **and** α
	$F = 5.67$ and $\alpha = 19.1$	A1	[6]	Allow $F = 15\sqrt{7}/7$
5 (i)	$a = 0.5\,\text{m s}^{-2}$	B1	[1]	
(ii)	[Distance = 25 + 100 + 5(5 + V) + 30V + 10V]	M1		For attempting to find the distance travelled
	$150 + 45V$ AG	A1		
	$150 + 45V = 465 \rightarrow V = 7\,\text{m s}^{-1}$	B1	[3]	
(iii)	½ × 80 × 7² – ½ × 80 × 5² [= 960]	M1		For change in KE
	20 × (5 + 7)/2 × 10 [=1200]	M1		For work done against friction using $F \times d$
	$[80gh = 960 + 1200]$	M1		For using PE loss = KE gain + WD against Res.
	$h = 2.7\,\text{m}$	A1	[4]	

6 (i)	[Work done = 50 cos10 × 20]	**M1**		Using WD = $Fd\cos\theta$
	= 984.8 J	**A1**	[2]	
(ii)	[984.8 = ½ × 25v^2 + 30 × 20]	**M1**		Using WD by DF = KE gain + WD against Res.
	v = 5.55 m s^{-1}	**A1**	[2]	
(iii)		**M1**		For using Power = Fv
	Max power = 50cos10 × 5.55 = 273 W	**A1**	[2]	Greatest power is at v_{max}
(iv)	[50 cos10 – 30 – 25g sin5 = 25a]	**M1**		For using Newton's 2nd law up the plane
	a = – 0.102 m s^{-2}	**A1**		
	[0 = 5.55 – 0.102t]	**M1**		For using $v = u + at$
	Time t = 54.4 s	**A1**	[4]	
	Alternative for 6(iv)			
		M1		For using WD by DF + KE loss = PE gain + WD against Res to find distance s up plane
	50 cos 10 × s + ½ × 25 × 5.55^2 = 25g × s sin 5 + 30 × s	**A1**		s = 151 m
		M1		For using s = ½(u + v)t
	t = 302/5.55 = 54.4 s	**A1**	[4]	
7 (i)	[15 – 6t = 0]	**M1**		For differentiation
	Max acceleration when t = 2.5 s	**A1**		May be stated from an a-t diagram
	Max acceleration = 18.75 m s^{-2}	**A1**	[3]	
(ii)	[Speed = 7.5t^2 – t^3 (+ c)]	**M1**		For using integration to obtain speed
	[Distance = 2.5t^3 – 0.25t^4 (+ ct + d)]	**M1**		For using integration to obtain distance
	= 2.5×125 – 0.25×625 = 156.25 m	**A1**	[3]	Allow distance = 625/4

(iii)	$v(5) = 7.5\times 25 - 125 = 62.5\ \mathrm{m\,s^{-1}}$	**B1**		Allow $v(5) = 125/2$
	$\int_5^k -\frac{625}{t^2}\,\mathrm{d}t = \left[\frac{625}{t}\right]_5^k$	**M1**		Integral with correct limits
	$= \frac{625}{k} - \frac{625}{5} = \frac{625}{k} - 125$	**A1**		
	$\frac{625}{k} - 125 = v(k) - v(5) = -62.5$	**M1**		Use of $v(5) = 62.5$ and $v(k) = 0$
	$k = 10$	**A1**	[5]	
	Alternative for 7(iii)			
	$v(5) = 7.5\times 25 - 125 = 62.5\ \mathrm{m\,s^{-1}}$	**B1**		
	$v(t) = \int -\frac{625}{t^2}\,\mathrm{d}t = \frac{625}{t} + c$	**M1**		Using indefinite integration
	$[c = -62.5]$ $v(t) = \frac{625}{t} - 62.5$	**A1**		For using $v(5) = 62.5$ to find c and setting $v(k) = 0$
	$v(k) = \frac{625}{k} - 62.5 = 0$	**M1**		
	$k = 10$	**A1**	[5]	