1		M1		For using Newton's 2nd law
	DF – 700 = 880 × 0.625	A1		
	[P = 1250 × 16]	M1		For using P = (DF)v
	P = 20 000	A1	[4]	
2	**(i)** X = 14 – 13cos θ and Y = 13sin θ or triangle with sides 13, 14, 15 and θ opposite 15	B1		
	[$14^2 + 13^2 – 2 \times 13 \times 14\cos\theta = 15^2$]	M1		For using $X^2 + Y^2 = R^2$ or cosine rule
	θ = 67.4	A1	[3]	
	(ii)	M1		For evaluating X or 15cos[$\tan^{-1}$(Y/X)]
	Component is 9 N	A1ft	[2]	
3	**(i)** PE gain is 32 000 J	B1	[1]	
	(ii) [KE gain = ½ 160 × 1.25^2]	M1		For using KE gain = ½ mv^2
	KE gain is 125 J	A1	[2]	
	(iii) WD by drum = 32 000 + 125 + 20 000	B1ft		
	[P = 52 125 ÷ 41.7]	M1		For using P = Δ (WD) ÷ Δ T
	Power is 1250 W	A1	[3]	
4	**(i)** [$a = 1.5t – 0.1875t^2$]	M1		For using a = dv/dt
	[0.1875t(8 – t) = 0]	DM1		For attempting to solve dv/dt = 0
	Acceleration is zero when t = 8	A1	[3]	
	(ii) Changes direction when t = 12	B1		
		M1		For using s = $\int v\mathrm{d}t$
	$s = 0.25t^3 – 0.0625t^4 \div 4$ (+ C)	A1		
	[s = 0.25 × 1728 – 0.0625 × 20736 ÷ 4]	DM1		For using limits 0 to (12) or equivalent
	Distance is 108 m	A1	[5]	

5	**(i)**	PE loss = $2g(10 - 10 \times 0.28)$	B1		
		$[\frac{1}{2} 2v^2 = 144]$	M1		For using $\frac{1}{2} mv^2$ = PE loss
		Speed is 12 ms^{-1}	A1	[3]	
	(ii)	$R = 2g \times 0.96$	B1		
		$[2g \times 0.28 - 2g \times 0.96 \div 12 = 2a]$	M1		For using Newton's 2nd law
		Acceleration is 2 ms^{-1}	A1	[3]	
	(iii)	$[v^2 = 12^2 + 2 \times 2 \times 10]$	M1		For using $v^2 = u^2 + 2as$
		Speed is 13.6 ms^{-1}	A1	[2]	
6	**(i)**		M1		For using Newton's 2nd law for P or for Q; or for using $(M - m)g \times 0.8 = (M + m)a$
		$0.6g \times 0.8 - T = 0.6a$ and $T - 0.4g \times 0.8 = 0.4a$ or $(0.6 - 0.4)g \times 0.8 = (0.6 + 0.4)a$	A1		
			M1		For solving for T or for a
		Tension is 3.84 N or acceleration is 1.6ms^{-2}	A1		
		Acceleration is 1.6 ms^{-2} or tension is 3.84 N	A1	[5]	
	(ii)	$2 = 1.6t_1$ $(t_1 = 1.25)$	B1ft		
			M1		For using $0 + u + at$ with $a = -0.8g$
		$0 = 2 - 0.8gt_2$ $(t_2 = 0.25)$	A1		
		Time taken in 1.5 s	A1ft	[4]	ft incorrect acceleration in **(i)**

7	**(i)**	M1		For resolving forces vertically and horizontally at B
	$T_C \times (2/2.5) - T_A \times (1.5/2.5) = 0$	A1		
	$T_C \times (1.5/2.5) + T_A \times (2/2.5) = 8$	A1		
	$[0.6\ T_C + 0.8\ (4T_C/3) = 8 \rightarrow (5/3)\ T_C = 8$ or $0.6(0.75T_A) + 0.8T_A = 8 \rightarrow 1.25T_A = 8\ ]$	M1		For eliminating T_A or T_C and attempting to find T_C or T_A
	Tension in AB is 6.4 N; tension in BC is 4.8 N	A1	[5]	
	(ii)	M1		For resolving forces vertically
	$F + 0.2\ g = T_A \times (1.5/2.5)$	A1		
	$N = T_A \times (2/2.5)$	B1		
	$[\mu = (3.84 - 2\ )/5.12]$	M1		For using $\mu = F/N$ with F vertical and N horizontal
	Coefficient is 0.359	A1	[5]	Accept 0.36