1	[Tcosα = mg]	M1		For resolving forces vertically
	Tension is 3.4 N	A1		
	[F = Tsinα]	M1		For resolving forces horizontally
	F = 1.6	A1	4	
2	**(i)** [WD = 30 × 20 × 0.6 + 40 × 20 × 0.8]	M1		For using WD = Fdcosθ
	Work done is 1000 J	A1	2	
	(ii)	M1		For applying F = μW and Newton's 2nd law with a = 0
	30 × 0.6 + 40 × 0.8 – 0.625W = 0	A1		
	Weight is 80 N	A1	3	
3	**(i)**	M1		For applying Newton's 2nd law to the bicycle/cyclist
	F – 780 × (36÷325) – 32 = 78 × (–0.2)	A2		(A2 for all correct, A1 for one error, A0 for more than one error)
	F = 103 (102.8 exact)	A1	4	
	(ii) $[0 = 7^2 + 2(-0.2)s]$	M1		For using $0 = u^2 + 2as$
	Distance is 122.5 m (accept 122 or 123)	A1	2	
4	**(i)** [– μmg = ma]	M1		For using Newton's 2nd law, F = μR and R = mg
	Decelerations of P and Q are $2\ ms^{-2}$ and $2.5\ ms^{-2}$.	A1	2	
	(ii)	M1		For using $s = ut + ½ at^2$ and $s_P = s_Q + 5$
	$8t - t^2 = 3t - 1.25t^2 + 5$	A1		
	$t = \sqrt{120} - 10$ (=0.95445…)	A1		
		M1		For using v = u + at for both P and Q
	Speed of P = $6.09\ ms^{-1}$, speed of Q = $0.614\ ms^{-1}$	A1	5	

5	**(i)** Gain in PE $=15000g \times 16$	B1		
	WD against resistance = 1800×1440	B1		
		M1		For using:– WD by driving force = Gain in PE + WD against resistance
	Work done is 4.99×10^6 J	A1	4	
	(ii)	M1		For using :– WD by engine = Increase in KE + WD against resistance
	$5030\,000 = \frac{1}{2}\,15\,000(24^2 - 15^2) + 1600d$	A1		
	Distance is 1500 m	A1	3	
6	**(i)**	M1		For applying Newton's 2nd law to A or to B
	$T - 0.3g = 0.3a$ or $0.7g - T = 0.7a$	A1		
	$0.7g - T = 0.7a$ or $T - 0.3g = 0.3a$ or $0.7g - 0.3g = (0.7 + 0.3)a$	B1		
	Tension is 4.2 N	A1	4	
	(ii) $a = 4$	B1		May be scored in **(i)**
	$s_{taut} = 1.6^2/(2 \times 4)$ $(= 0.32)$	B1		
	$[(0.52 + 0.32) = -1.6t + 5t^2]$	M1		For using $s = ut + \frac{1}{2}gt^2$
	$[(t - 0.6)(5t + 1.4) = 0]$	M1		For solving the resultant quadratic equation.
	Time taken is 0.6 s	A1	5	
	Alternative Marking Scheme for the last three marks			
	$0^2 = 1.6^2 - 2gs_{up}$, $t_{up} = 2s_{up}/(1.6 + 0)$ $(= 0.16)$	M1		For using kinematic formulae to find t_{up}
	$0.52 + s_{taut} + s_{up} = 0 + \frac{1}{2}gt_{down}^2$ $(t_{down} = 0.44)$	M1		For using kinematic formulae to find t_{down}
	Time taken $= t_{up} + t_{down} = 0.6$ s	B1		

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7	**(i)**			For integrating 0.6t and using v(0) = 0 (may be implied by absence of constant of integration)
		M1		
	$v(t) = 0.3t^2$	A1		
		M1		For integrating v(t) and using s(0) = 0 (may be implied by absence of constant of integration)
	$s(t) = 0.1t^3$	A1		
	Velocity is 30 ms^{-1} and displacement is 100 m	A1	5	
	(ii)	M1		For integrating –0.4t and using v(10) = 30
	$v(t) = -0.2t^2 + 50$	A1		
	At A, $-0.2t^2 + 50 = 0 \rightarrow t = \sqrt{250}$	B1		
		M1		For integrating v(t) and using s(10) = 100
	$s(t) = -t^3/15 + 50t - 1000/3$	A1		
		M1		For finding $s(\sqrt{250})$
	Distance OA is 194 m	A1	7	