1	**(i)**	[DF – 600 = 700 × 2]	M1		For using Newton's second law (3 terms needed)
		Driving force is 2000 N	A1	**[2]**	
	(ii)	[P = 2000 × 15]	M1		For using P = Fv
		Rate of working is 30000 W (or 30 kW)	A1ft	**[2]**	
2	**(i)**	Gain in PE = 1250g × 1.54 (= 19250 J)	B1		
		[WD = 1250g × 1.54 + 5750]	M1		For using WD by crane = Gain in PE + WD against resistance
		Work done is 25000 J (or 25 kJ)	A1	**[3]**	
	(ii)	[1250 = 25000 / T]	M1		for using P = Δ(WD) / Δt
		Time is 20 s	A1ft	**[2]**	ft Ans**(i)** ÷ 1250
3			M1		For resolving forces horizontally or vertically (3 terms needed)
		$T\cos\theta + T\sin\theta = 15.5$	A1		AEF
		$-T\cos\theta + T\sin\theta = 8.5$	A1		AEF
			DM1		For solving for $T\sin\theta$ and $T\cos\theta$
		$T\sin\theta = 12$ and $T\cos\theta = 3.5$	A1		AG
		$\theta = 73.7^o$ (or 1.29^c)	B1	**[6]**	
4	**(i)**		M1		For resolving forces parallel to the plane (either case) – 3 terms needed
		$2X + F = 11g\sin30^o$ and $9X – F = 11g\sin30^o$	A1		
		X = 10	A1	**[3]**	
	(ii)	F = 35	B1		May be implied.
		$R = 11g\cos30^o$	B1		
			DM1		For using μ = F/R
		Coefficient is 0.367	A1ft	**[4]**	
5	**(i)**	v(600) = 0.025 × 600	B1		
			M1		For using $0 = v(600 + 2600) – 0.0375t_3$ and $v(600 + 2600) = v(600)$
		$0 = 15 – 0.0375t_3$	A1		
		Total time is 3600 s	A1	**[4]**	
	(ii)	For correct graph	M1		Shape only
		[d = ½ (2600 + 3600) × 15 or $d = ½\ 0.025 \times 600^2 + 2600 \times 15 + ½\ 0.0375 \times 400^2$]	A1ft		For method of finding distance
		Distance is 46500	A1ft	**[3]**	
	(iii)	Values of t are 300 and 3400	B1	**[1]**	

6	**(i)**		M1		For using $s = \int v\,dt$
		$s = 2t^2 - t^4/64$ (+ C)	A1		
		$[t^4 - 128t^2 + 64^2 = 0]$	M1		For attempting to solve s(t) = 64
		$(t^2 - 64)^2 = 0$	A1		
		Time taken is 8 s	A1	**[5]**	
	(ii)		M1		For using a = dv/dt
		$a = 4 - 3t^2/16$	A1		
		a is positive for $0 < t < \frac{8}{\sqrt{3}}$ or $0 < t < 4.62$	B2	**[4]**	SR: Allow B1 for $t < \frac{8}{\sqrt{3}}$ SR: B1 for $0 \le t \le \frac{8}{\sqrt{3}}$ or 4.62
7	**(i)**		M1		For applying Newton's second law to A or to B
		T – 12 = 1.2a and 20 –T = 2a	A1		Accept (2 – 1.2)g = (2.0 + 1.2)a as an alternative for one of these equations
		Acceleration is 2.5 ms^{-2}	B1		
		Tension is 15 N	A1	**[4]**	
	(ii)	**(a)** PE gain = 12 × 1.5 = 18 J	B1		
		(b) WD on A = 15 × 1.5 = 22.5J	B1		
		(c) Gain in KE = ans**(b)** – ans**(a)** = 4.5 J	B1ft	**[3]**	alt: KE = ½ 1.2(2 × 2.5 × 1.5) = 4.5J
	(iii)	v = 1.6 × 2.5	B1ft		
			M1		For using v = u – gt
		t = 0.4 s	A1		May be implied
		Total time taken is 0.8 s	A1	**[4]**	