1 (i)	$200g \times 0.7$	**M1**		For using WD = $mg \times h$
	Work done = 1400 J	**A1**	2	
(ii)	1400 / 1.2	**M1**		For using Power = WD / Time
	Average Power = 1170 W	**A1√**	2	
2 (i)	$a = g\sin30 = 5$	**B1**		
	$2.5 = 0 + 5t$	**M1**		Using $v = u + at$
	$t = 0.5$ Time = 0.5 s	**A1**	3	
(ii)	$v^2 = 0 + 2 \times 5 \times 3 = 30$	**B1**		
	$-1 = 0.5a \rightarrow a = -2$			For applying Newton's second law to the particle and using $v^2 = u^2 + 2as$
	$0 = 30 + 2 \times (-2) \times s$	**M1**		
	Distance = 7.5 m	**A1**	3	
	First alternative method for 2(ii)			
	$v^2 = 0 + 2 \times 5 \times 3 = 30$	**B1**		
	$0.5 \times 0.5 \times 30 = 1 \times$ distance	**M1**		KE lost = WD against Friction
	Distance = 7.5 m	**A1**	3	
	Second alternative method for 2(ii)			
	PE lost = $0.5 \times 10 \times 3 \sin30 = 7.5$	**B1**		Using PE lost = mgh
	$7.5 = 1 \times$ distance	**M1**		PE lost = WD against Friction
	Distance = 7.5 m	**A1**	3	
3 (i)		**M1**		For applying Newton's second law to the lorry up the hill
	$F - 24000g \sin 3 - 3200 = 24000 \times (0.2)$	**A1**		[$F = 20561$]
	Power = $Fv = 20561 \times 25$	**M1**		Using $P = Fv$
	Power = 514 kW	**A1**	4	
(ii)	DF = $3200 + 24000g \sin 3$ [=15761]	**M1**		Using Newton's second law up the hill in the steady case
	$v = 500000 / 15761 = 31.7 \text{ ms}^{-1}$	**A1**	2	$P = Fv$ so $v = P / F$

4	$F = 0.2 \times mg \cos 35$	B1		Maximum value of F
		M1		For resolving forces along the plane in either case
	$5g - mg \sin 35 - 0.2\, mg \cos 35 = 0$	A1		Equilibrium, on the point of moving up the plane
	$5g - Mg \sin 35 + 0.2\, Mg \cos 35 = 0$	A1		Equilibrium, on the point of moving down the plane
	$m = 6.78$ or $M = 12.2$	M1		For solving either
	$6.78 \leqslant \text{mass} \leqslant 12.2$	A1	6	
5 (i)		M1		For resolving forces either horizontally or vertically
	$F\cos70 + 20 - 10 \cos 30 = R\cos15$	A1		
	$10\sin30 - F \sin70 = R \sin15$	A1		
		M1		For solving simultaneously
	$F = 1.90$ N **and** $R = 12.4$ N	A1	5	
	Alternative method for 5(i)			
	$[X = 0.342\, F + 11.34$ $Y = 0.94\, F - 5]$	M1		For finding components of the forces in the x and y directions
	$(0.342\, F + 11.34)^2 + (0.94\, F - 5)^2 = R^2$	A1		
	$\tan15 = (5 - 0.94F) / (0.342F + 11.34)$	A1		
		M1		Solve the tan 15 equation for F and substitute to find R
	$F = 1.90$ N **and** $R = 12.4$ N	A1	5	
(ii)	$11.7^2 = 0 + 2a \times 3$			
	$a = 22.815$	B1		
	$R \cos15 = m \times 22.815$	M1		Applying Newton's second law to the particle in direction AB
	Mass of bead = 0.526 kg	A1	3	

6 (i)	$s = 0.3t^2 - 0.01t^3$	**M1**		For integration
	$s(5) = 0.3 \times 5^2 - 0.01 \times 5^3 = 6.25$	**A1**		
	$a = 0.6 - 0.06t$	**M1**		For differentiation
	$a(5) = 0.6 - 0.0 \times 5 = 0.3 \text{ ms}^{-2}$	**A1**	4	
(ii)	Maximum velocity is when $0.6 - 0.06t = 0$	**M1**		For setting $a = 0$
	[$t = 10$]	**M1**		For solving $a = 0$
	Max velocity = 3 ms^{-1}	**A1**		
	$0.6t - 0.03t^2 = 1.5$			Setting velocity = half its maximum and attempting to solve a three term quadratic
	[$t^2 - 20t + 50 = 0$]	**M1**		
	Times are 2.93 s	**A1**		
	and 17.07 s	**A1**	6	

7 (i)	$36 = 0 + 0.5 \times 0.5t^2$			
	$t = 12$	**B1**		
	$v^2 = 0 + 2 \times 0.5 \times 36$			
	$v = 6$	**B1**		
	$s = 6 \times 25$			
	remaining distance $= 210 - 36 - 150 = 24$	**B1**		
	$24 = (6 + 0)/2 \times t$	**M1**		Using $s = (u + v)t/2$
	$t = 8$			
	Total Time = 12 + 25 + 8 = 45 s	**A1**	5	
(ii)	Distance travelled by cyclist $= 36 + 6(t - 12)$	**M1**		For attempting distance travelled by cyclist for $t > 12$
	Distance travelled by car $= 0.5 \times 4 \times (t - 24)^2$	**M1**		For attempting distance travelled by car
	$2t^2 - 96t + 1152$ $= 36 + 6t - 72$ $[t^2 - 51t + 594 = 0]$	**M1**		Equating expressions and attempting to solve a three term quadratic equation
	$t = 33$ or $t = 18$	**A1**		
	Time = 33 s	**B1**	5	Choosing the correct solution