Question	Answer	Marks	Guidance
1	[12 cos 25 = 3a]	**M1**	For use of Newton's second law
	a = 4 cos 25 = 3.625	**A1**	
	[s = ½ × 4cos 25 × 5^2]	**M1**	For use of $s = ut + ½at^2$ OE
	Distance = 45.3 m	**A1**	
		4	

Question	Answer	Marks	Guidance
2(i)	Power = 1150 × 12 = 13 800W	**B1**	For use of $P = F \times v$ Allow 13.8 kW
		1	
2(ii)	Driving force = $\frac{25000}{12}$	**B1**	Using $F = \frac{P}{v}$
	$\frac{25000}{12} - 1150 - 3700g \sin 4 = 3700a$	**M1**	For applying Newton's 2nd law up the slope, 4 terms
	a = –0.445 m s^{-2}	**A1**	
		3	
2(iii)	$\frac{25000}{v} - 1150 - 3700g\sin 4 = 0$	**M1**	For stating the equation for constant v, with 3 terms, and solving for v
	v = 6.70 m s^{-1}	**A1**	
		2	

Question	Answer	Marks	Guidance
3(i)	640 × 18	**M1**	For use of work done = $F \times d$
	Work done = 11 520 J	**A1**	
		2	
3(ii)	KE at start = ½ × 840 × 14^2 = 82 320 J	**B1**	
	PE gained = 840g × 8sin 30 – 840g × 10sin 20 = 4870 J	**B1**	
	½ × 840 × v^2 = 82 320 – 11 520 – 4870	**M1**	For using work – energy equation with 4 terms and solving for v
	v = 12.5 m s^{-1}	**A1**	
		4	

Question	Answer	Marks	Guidance
4(i)	Acceleration = $\frac{(-25)}{2.5} = -10$ m s^{-2}	**B1**	AG
		1	
4(ii)	$V = -15 + 7.5 \times 4$	**M1**	Using v–t graph OE
	$V = 15$ m s^{-1}	**A1**	
		2	
4(iii)	Using $v = 0$ at $t = 4.5$ and $t = 8$	**B1**	
		M1	Attempting to use area to find total distance travelled
	½ × (4.5 + 2) × 10 + ½ × (8 – 4.5) × 15 + ½ × (T – 8) × 15 = 100	**M1**	For setting up an equation for total distance travelled and solving for T
	$T = 13.5$	**A1**	
		4	

Question	Answer	Marks	Guidance
5(i)	Acceleration = 0.4 m s^{-2}	**B1**	
		1	
5(ii)	$\frac{100}{t^2} - 0.1t = 0$	**M1**	For setting $v = 0$ and solving for t
	$t = 10$ s	**A1**	
		2	
5(iii)	Distance $t = 0$ to $t = 5$ is ½ (1.5 + 3.5) × 5 = 12.5	**B1**	Trapezium rule or integration
	$s(t) = \int\left(\frac{100}{t^2} - 0.1t\right)dt$	**M1**	For integration
	$= -\frac{100}{t} - 0.05t^2\,(+C)$	**A1**	Correct integration
	$s(10) - s(5)$	**M1**	Use limits 5 and 10 used or find + C
	Total distance = 12.5 + 6.25 = 18.75 m	**A1**	
		5	

Question	Answer	Marks	Guidance
6(i)		**M1**	For resolving forces (either direction)
	$X = 75 + 50 \cos 60$ (= 100) $Y = 50 \sin 60$ (= 43.3)	**A1**	For both equations, unevaluated
	Resultant = $\sqrt{(100^2 + 43.3^2)} = 109$ N	**B1**	
	Angle = $\arctan\left(\frac{43.3}{100}\right) = 23.4°$	**B1**	Must state anticlockwise from the positive x-axis or show in a diagram
		4	
6(ii)	$50 \cos \alpha - F \cos 50 = 0$	**B1**	Resolving forces horizontally
	$50 \sin \alpha - 3F - F \sin 50 = 0$	**B1**	Resolving forces vertically
	$\tan \alpha = \frac{(3F + F \sin 50)}{(F \cos 50)}$	**M1**	For division to find θ or for using Pythagoras to find F
	$\alpha = 80.3$	**A1**	
	$F = 13.1$	**A1**	
		5	

Question	Answer	Marks	Guidance
7(i)		**M1**	For applying Newton's 2nd law to either particle (correct number of terms)
	$T - 0.9g \sin 15 = 0.9a$	**A1**	
	$2.5 + 0.4g \sin 25 - T = 0.4a$	**A1**	
	$1.3a = 1.86…$	**M1**	Solving simultaneously for a
	$a = 1.43$ m s^{-2}	**A1**	
		5	

Question	Answer	Marks	Guidance
7(ii)	$F = 0.8 \times 0.4g \cos 25$	**B1**	
	$2.5 + 0.4\,g \sin 25 - T - F = 0$	**M1**	For using equilibrium of forces acting on particle B with 4 terms
	$T - 0.9\,g \sin \theta = 0$	**M1**	For using equilibrium of forces acting on particle A with 2 terms
		M1	For solving for θ
	$\theta = 8.2°$	**A1**	
		5	