Q	Mark Scheme	Marks	Marking guidance
8 (a)	Normal reaction between P and ramp $(R) = 0.3g\cos\alpha = \left(0.3g \times \frac{24}{25} = 2.82...\right)$	M1	Seen or implied. Condone sin / cos confusion (implied by use of $\frac{7}{25}$)
	Work done against friction $= \frac{1}{5}R \times 15$	M1	Use of $\text{WD} = \mu R \times \text{distance}$ with their R
	$= 8.47(8.5)(\text{J})$	A1	3 sf or 2 sf
		3	
8 (b)	Work-energy equation	M1	All terms required. Dimensionally correct. Condone sign errors.
	$\frac{1}{2} \times 0.3U^2 = \frac{1}{2} \times 0.3 \times 25^2 + (\text{a}) + 0.3 \times g \times (15\sin\alpha)$	A1ft A1ft	Follow their answer to (a) Correct unsimplified equation with at most one error. Correct unsimplified equation
	$U = 27.6 \quad (28)$	A1	3 sf or 2 sf
		4	
8 (c)	Time to ground:	M1	Complete method using *suvat* to form an equation in t
	$-15\sin\alpha = 7t - \frac{1}{2}gt^2$	A1ft	Correct unsimplified equation in t ft their 4.2
	$t = 1.88 \quad (1.9) \quad (\text{s})$	A1	3 sf or 2 sf $\frac{5+\sqrt{67}}{7}$ is A0
		3	
8 (d)	Vertical component of speed	M1	Or use energy to find the speed
	$= \pm(7 - (\text{their } t) \times 9.8) \quad (\pm 11.459....)$	A1ft	or $0.15 \times 625 + .3 \times 9.8 \times \text{their } 4.2 = 0.15v^2$ $(v = 26.59....)$ condone $v = \frac{7\sqrt{67}}{5}$
	Correct use of trig: $\tan\theta° = \frac{\text{their vertical}}{24}$	M1	or $\cos\theta° = \frac{24}{\text{their speed}}$
	$\theta = 25.5\,(26)$	A1	3 sf or 2 sf
		4	
	Reminder: The accuracy penalty for overspecified answers should be applied only once in any question (the first time seen). Similarly for the use of g = 9.81. If they make both of these errors they lose 2 A marks. The penalty applies to the final mark in any part.		
		(14)	

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