8a	Condone use of θ or a mixture of θ and α throughout but final answer should be in one variable.		
	Equation for horizontal distance	M1	Complete method using *suvat.* Condone sine / cosine confusion
	$x = u\cos\alpha\, t$	A1	Correct only
	Equation for vertical distance	M1	Complete method using *suvat.* Condone sine / cosine confusion and sign error
	$y = u\sin\alpha\, t - \frac{1}{2}gt^2$	A1	Correct only
	$t = \frac{x}{u\cos\alpha} \Rightarrow$ $y = u\sin\alpha.\frac{x}{u\cos\alpha} - \frac{g}{2}\left(\frac{x}{u\cos\alpha}\right)^2$	DM1	Substitute for *t* to obtain *y* in terms of *x* and α Dependent on the 2 preceding M marks
	$\Rightarrow y = x\tan\alpha - \frac{gx^2}{2u^2}\left(1+\tan^2\alpha\right)$ *	A1*	Obtain **given answer** from full and correct working. Need some evidence for the final step. $\frac{1}{\cos^2\alpha} = 1+\tan^2\alpha$ is not sufficient.
		6	
8b	Conservation of energy:	M1	Method specified in the question. Need all terms and dimensionally correct. Condone sign errors
	$\frac{1}{2}m\times 25^2 = \frac{1}{2}mU^2 + mg\times 20$	A1	Correct unsimplified equation
	$U = 15.3\ (15)$	A1	3 sf or 2 sf only
		3	
8c	Use part (a) or work from first principles to form an equation in $\tan\theta$	M1	$\left(-20 = 30\tan\theta - \frac{9.8\times 900}{2U^2}\left(1+\tan^2\theta\right)\right)$
	Obtain $18.9\tan^2\theta - 30\tan\theta - 1.07 = 0$ $\left(\frac{4410}{233}\tan^2\theta - 30\tan\theta - \frac{250}{233} = 0\right)$	A1ft	Or 3 term equivalent Follow their *U* Can be implied by a correct final answer
	$\Rightarrow \theta = 58.3°$ or $58°$	A1	3 sf or 2 sf only
		3	
		(12)	

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