Question Number	Scheme	Marks
8.	**N.B.** In parts (a) and (c), $g = 9.8$ could appear in the working but final answers must be using g. In (b), $g = 9.8$ could be used in their answer. In (d), $g = 9.8$ could appear throughout in the working. **N.B.** For any equation of motion, if they use an incorrect mass in the 'ma' term, award M0 for the equation. However, if the correct mass has been used in (c), treat an error in the 'ma' term in (d) as a slip.	
8(a)	$R = 2mg\cos\alpha$	M1A1
	$F = \frac{11}{36}\times 2mg\times\frac{12}{13} = \frac{22mg}{39}$ *	A1* (3)
8(b)	$3mg - T = 3ma$	M1A1 (2)
8(c)	$T - \frac{22mg}{39} - 2mg\sin\alpha = 2ma$ $\quad (T - \frac{4mg}{3} = 2ma)$ **OR:** $3mg - \frac{22mg}{39} - 2mg\sin\alpha = 5ma$	M1A1
	Solve for a in terms of g **N.B.** Must reach $a = kg$ from **their** equations	M1
	$a = \frac{1}{3}g$ *	A1* (4)
8(d)	$v^2 = \frac{2gh}{3}$	B1
	$-\frac{22mg}{39} - 2mg\sin\alpha = \pm 2ma$ **OR** PE Gain = $2mgd\sin\alpha$	M1
	$\pm\frac{2g}{3} = a$ $\quad =\ \frac{10mgd}{13}$	A1
	$0 = \frac{2gh}{3} - 2\times\frac{2g}{3}\times d$ $\frac{22mgd}{39} = \frac{1}{2}\times 2m\times\frac{2gh}{3} - \frac{10mgd}{13}$	M1
	$d = \frac{1}{2}h$ $\quad d = \frac{1}{2}h$	A1
	Total distance = $\frac{1}{2}h + h = \frac{3}{2}h$	A1 ft (6)
		(15)

	Notes	
	N.B. For (a) and (c), if fractions for the trig ratios are not seen or implied, only penalise once.	
8(a)	M1: Resolve perp to the plane, correct terms, condone cos/sin confusion and sign errors. Allow if they use $\cos(\frac{12}{13})$ or similar.	
	A1: Correct equation	
	A1*: Correct given answer correctly obtained, must see $\frac{12}{13}$	
8(b)	M1:Equation of motion for *B*, correct terms, condone sign errors	
	A1: Correct equation	
8(c)	M1:Equation of motion for *A* **OR** whole system, correct terms but allow *F*, condone sign errors and sin/cos confusion. Allow if they use $\sin(\frac{5}{13})$ or similar.	
	A1: Correct equation	
	M1: Solve for *a* in terms of *g*, need to see trig substituted and must be solving 2 equations in *T* and *a* **OR** using a whole system equation with correct terms.	
	A1*: Correct given answer correctly obtained, must see $\frac{5}{13}$	
	N.B. Allow a full verification, using the equations of motion for *A* and *B* **OR** the whole system equation.	
8(d)	B1: seen or implied	
	M1:Equation of motion for *A*, correct terms, condone sign errors and sin/cos confusion	
	A1: Correct acceleration or deceleration of *A*	
	M1: Complete method to find an equation in *d*, *g* and *h* only, using a new calculated *a*	
	A1: cao	
	A1ft: Their *d* (which must be a multiple of *h*) + *h*. **N.B.** This mark is only dependent on the previous M.	
	OR: Using Work-energy	
	B1: cao	
	M1: PE gain of *A*, condone sign errors and sin/cos confusion	
	A1: Correct PE gain	
	M1: Use of work-energy principle to obtain an equation in *m*, *d*, *g* and *h* only, using their PE expression	
	A1: cao	
	A1ft: Their *d* (which must be a multiple of *h*) + *h*, with the final answer of the form *kh*.	

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