11	**(a)**		Dist. from A to the wall along the ladder: $(l=)\frac{h}{\sin 30}$	**B1**	**3.1a**		$(l=)2h$
				M1	**3.3**	Moments about A (each term must therefore by a force × distance) – three terms, both weights resolved (but allow sin/cos confusion), allow sign errors (M0 if only using masses)	M0 if the contact force at the wall appears as a component in their equation
			$2mgd\cos 30 + mga\cos 30 = R_w l$	**A1**	**1.1**	Correct LHS and RHS with their $l=\alpha h$ - A0 if $l = 2a$	$\alpha \neq 0$, 1
			$R_w = \frac{1}{2h}\left(2mgd\,\frac{\sqrt{3}}{2} + mga\,\frac{\sqrt{3}}{2}\right) = \frac{1}{4h}(2mgd + mga)\sqrt{3}$ $R_w = \frac{mg(a+2d)\sqrt{3}}{4h}$	**A1**	**2.2a**	**AG** www – note that using $l = 2a$ but then stating $a = h$ is M1 only	Enough working must be shown as AG
				[4]			
11	**(b)**			**M1***	**3.3**	Resolve vertically (three or four terms (if both weights not combined)) – reaction at the wall resolved – allow sign errors and sin/cos confusion (must be using mg not m)	R_A is the normal contact force at A
			$R_w\cos 30 + R_A = 2mg + mg$	**A1**	**1.1**	oe	
				M1*	**3.3**	Resolve horizontally (allow sin/cos confusion) – two terms only	F_A is the frictional contact force at A
			$F_A = R_w \sin 30$	**A1**	**1.1**	oe	
			$R_w \sin 30 = \frac{\sqrt{3}}{8}(3mg - R_w\cos 30)$	**M1dep***	**3.4**	Use of $F = \frac{\sqrt{3}}{8}R$ with their expressions for F_A and R_A – dependent on previous M marks	Either in terms of R_w, m and g or a, d and h (and m, g)
			$\frac{mg(a+2d)\sqrt{3}}{8h} = \frac{\sqrt{3}}{8}\left[3mg - \frac{3mg(a+2d)}{8h}\right]$	**A1**	**3.4**	Correct equation in terms of (m, g) a, d and h	Condone non-exact values for this A mark
			$h = \frac{11}{24}(a+2d)$	**A1**	**2.2a**	$k = \frac{11}{24}$ oe www (must be exact value of k)	From exact working
				[7]		For reference: $k = 0.45833\ldots$	

11	**(c)**		$\frac{11}{24}(a+2d) \leq a$ $d \leq \frac{13}{22}a$ so greatest possible value of d is $\frac{13}{22}a$	**M1** **A1** **[2]**	**3.1b** **2.2a**	Uses the condition that h cannot exceed $2a\sin 30$ ($= a$) – allow if in terms of k or their incorrect k (e.g. $k(a+2d)=a$ is M1) Allow $d \leq \frac{13}{22}a$ or $d = \frac{13}{22}a$	Allow any inequality sign or equals A0 if exact answer not seen
11	**(d)**		e.g. model the ladder as non-uniform e.g. include a frictional component for the contact of the ladder with the wall e.g. consider the size of the object at C e.g. consider the thickness of the ladder e.g. consider the fact that the ladder could bend	**B1** **[1]**	**3.5c**	B0 if suggestion is to model the ground as smooth B0 for using a more accurate value for g	