

Question Number	Scheme	Marks
4(a)	Max ht $v = 0$. $v = u - gt \Rightarrow T = \frac{u}{g}$	M1A1 (2)
(b)	Max ht $H = ut + \frac{1}{2}at^2 = \frac{u^2}{g} - \frac{u^2}{2g} = \frac{u^2}{2g}$ Or use of $v^2 = u^2 + 2as$	* Given answer* M1A1 (2)
(c)	$-3 \times \frac{u^2}{2g} = ut - \frac{1}{2}gt^2$ $-3u^2 = 2ugt - g^2t^2$ $g^2t^2 - 2ugt - 3u^2 = 0, \quad gt = \frac{2u \pm \sqrt{4u^2 + 12u^2}}{2}$ $t = \frac{3u}{g} = 3T$	M1 DM1 A1 A1 (4)
(c) alt	$-4H = -\frac{1}{2}gt^2$ Total time $= T + \sqrt{\frac{8H}{g}} = T + \sqrt{\frac{8u^2}{2g^2}}$ $= T + 2T = 3T$	M1 DM1A1 A1 (4)
		[8]

Notes for Question 4

Question 4

In this question, condone sign errors in a suvat equation for the M mark, but a missing term is M0 or an incorrect term is M0. An incorrect suvat formula is M0

Allow use of symmetry of motion.

e.g. in (a), using $v = u + at$, either $0 = u - gT$ or $u = 0 + gT$

Question 4(a)

M1 for use of suvat to obtain an equation in T , u and g only.

A1 for $T = u/g$ correctly obtained.

Question 4(b)

M1 for use of suvat to obtain an equation in H , u and g only.

A1 for $H = u^2/2g$ correctly obtained (**given answer**)

Question 4(c) Watch out for t / T confusion (N.B. if only T 's used, M0DM0)

First M1 for a complete method to find the total time in terms of u , g , H or T :-

either: $3H = -ut + \frac{1}{2}gt^2$

or: $4H = \frac{1}{2}gt^2$ and $t + T$

or: $v^2 = u^2 + 6gH$ and $v = -u + gt$, with v eliminated

Second M1, **dependent on first M1**, for producing an expression, in terms of u , g , H or T , for the total time, by solving a quadratic

First A1 for any correct expression for the total time in terms of u , g , H or T .

Second A1 for $3T$ cso