8a	Equation of motion for P **N.B.** In (a) and (b), for both equations of motion, must be using the correct mass to score the M mark.	M1	Dimensionally correct. Need all terms. Condone sign errors. **N.B**. Allow if a is used instead of $\frac{1}{5}g$
	$T - kMg = \frac{1}{5}kMg$	A1	Correct only. **N.B.** A0 if a is used here unless subsequently is replaced by $\frac{1}{5}g$ at any stage in the question.
		(2)	
8b	Another equation of motion	M1	Condone whole system equation. **N.B**. Allow if a is used instead of $\frac{1}{5}g$
	For Q: $3Mg - T = \frac{3}{5}Mg$ **OR** For system: $3Mg - kMg = \frac{1}{5}(kM + 3M)g$	A1	or equivalent in either case. **N.B.** A0 if a is used here unless subsequently is replaced by $\frac{1}{5}g$ at any stage.
	Obtain $k = 2$	A1	Correct only
		(3)	
8c	Complete method to obtain equation in T only e.g. $T - g = \frac{1}{5}g$ **OR** $1.5g - T = \frac{3}{5} \times 0.5g$	M1	Use of their $k = 2$ and/or $M = 0.5$ in **their** equation of motion for P or Q Condone sign errors.
	Use of force = $2T$	M1	Their T must be substituted. Independent M mark.
	$\frac{12}{5}g = 24$ or 23.5(N)	A1	2 sf or 3 sf only Allow $\frac{12}{5}g$ oe
		(3)	
8d	Complete method to obtain the speed of Q when it hits the ground, must be using $a = \frac{1}{5}g$ and $s = 2.5$ e.g. $v = \sqrt{2 \times \frac{1}{5}g \times 2.5}$	M1	Condone sign errors.

	$v=\sqrt{g}=\frac{7}{\sqrt{5}}=3.13049...$	A1	Any of these but allow 3.1 or better
	$\pm 1.5\left(0.4-\left(-v\right)\right)$	M1	Condone sign errors, *v* does not need to be substituted. **N.B.** Allow use of 3*M*, *M* or 0.5 for mass.
	$=\pm 1.5\left(0.4+\sqrt{g}\right)$ oe	A1	Or with $\sqrt{g}$ = 3.1 or better
	Obtain 5.3 or 5.30 (Ns)	A1	2 sf or 3 sf only
		(5)	
8e	Use of *suvat* with correct acceleration to find an equation in t_1 OR t_2 only. e.g. For t_1, any of : $\sqrt{g}=\frac{1}{5}gt_1$ $2.5=\frac{1}{2}\times\frac{1}{5}gt_1^2$ $2.5=\frac{1}{2}(0+\sqrt{g})t_1$ $2.5=\sqrt{g}t_1-\frac{1}{2}\times\frac{1}{5}gt_1^{\,2}$ **OR** e.g. For t_2 $0=\sqrt{g}-gt_2$ or any other complete method e.g. find *s* (0.5) and use it to find t_2	M1	Complete *suvat* method to find an equation in a relevant time. Condone sign errors. **N.B**. If using their *v* ($\sqrt{g}$) from part (d), it must have come from a correct method. **N.B.** t_1 may have been found in (d) but must be used in (e) to gain credit.
	Obtain $t_1=\frac{5}{\sqrt{g}}=\frac{5\sqrt{5}}{7}=1.5971..$ **OR** $t_2=\frac{1}{\sqrt{g}}=\frac{\sqrt{5}}{7}=0.319438..$	A1	Any of these but allow t_1 = 1.6 or better **OR** Any of these but allow $t_2=0.3$ or better
	Complete correct method for total time = t_1+t_2	M1	Correct use of *suvat* and correct accelerations
	$1.9\left(\text{s}\right)$ or $1.92\left(\text{s}\right)$	A1	2 sf or 3 sf only
		(4)	
		(17)	

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