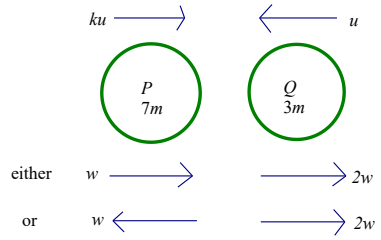
Question Number	Scheme	Marks	Notes
2a			
			N.B. Must be using correct pairings of masses and velocities for all M marks in this question.
	Use of $I = mv - mu$ for Q	M1	Dimensionally correct and subtraction seen or implied. (They are subtracting a negative, so they could go direct to "+") M0 for impulse-momentum for *P* or use of *m* for mass if not subsequently replaced. Condone sign errors. .
	$\frac{7}{2}mu = 3m\left(2w - \left(-u\right)\right)$	A1	Correct unsimplified equation in *u* and *w*
	$w = \frac{1}{12}u$	A1	0.083*u* or better N.B. Must be a single decimal or fraction
		[3]	
2b	Use of $I = mv - mu$ for *P* or equivalent	M1	Use impulse-momentum for *P* or CLM for one valid option with their *w* substituted, which must be a multiple of *u* but could also contain *k*'s if they've used CLM in (a). Allow an extra *g* throughout the CLM equation or *m* cancelled consistently. Condone sign errors.

			M0 for impulse-momentum for Q or use of *m* for mass if not subsequently replaced.
	EITHER: (see diagram) $-\frac{7mu}{2}=7m\left(\frac{u}{12}-ku\right)$ or $7mku-3mu=\frac{7mu}{12}+\frac{6mu}{12}$ OR: (see diagram) $\frac{7mu}{2}=7m\left(\frac{u}{12}-\left(-ku\right)\right)$ or $7mku-3mu=\frac{-7mu}{12}+\frac{6mu}{12}$	A1ft	Correct unsimplified equation for *k* but allow uncancelled *m*'s. Follow their *w*
	EITHER: $k=\frac{7}{12}$	A1	0.58 or better (0.58333..) N.B. $k=\frac{7}{12}$ must be entered on ePEN for this A mark.
	Use of $I=mv-mu$ for *P* or equivalent	M1	Use impulse-momentum or CLM correctly for second valid option with their *w* substituted.- i.e. the velocity of *P* should have the opposite sign to that used in their first equation. Allow an extra *g* throughout the CLM. equation or *m* cancelled consistently. .
	OR: $k=\frac{5}{12}$	A1	0.42 or better (0.41666..) N.B. $k=\frac{5}{12}$ must be entered on ePEN for this A mark.
		[5]	
		(8)	