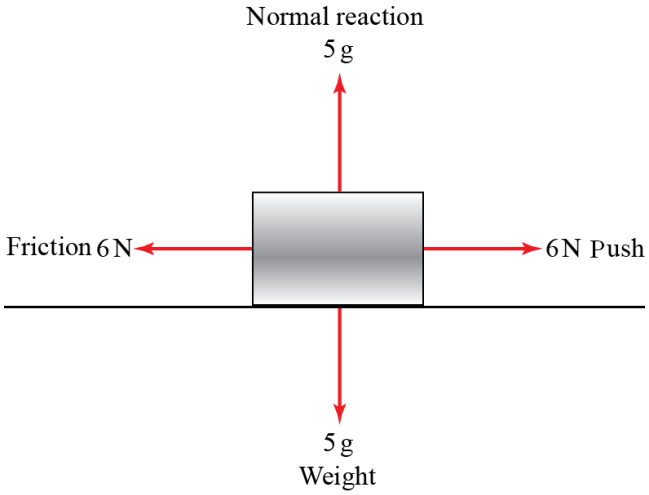
Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
5.1a	 Force descriptions in words × 3 (one mark each) Force values ×3 (one mark each)	 **B3** **B3**	 2.5 1.1b	3rd Draw force diagrams.
		(6)		
5.1b	Limiting equilibrium means $F = \mu R$	**M1**	3.1b	7th The concept of limiting equilibrium.
	$P = 0.3 \times 9.8 \times 5$	**M1**	1.1b	
	$P = 14.7$ (N) accept awrt 15 (N)	**A1**	1.1b	
		(3)		
				(9 marks)

Notes

5.1b

Allow if g explicitly evaluated.

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
6.2a	Calculate initial velocities.	M1	3.1a	7th Solve problems in familiar contexts involving projectile motion.
	Initial horizontal velocity $= 2 \times \cos 45 = \sqrt{2}$ (m s^{-1}).	A1	1.1b	
	Initial vertical velocity $= 2 \times \sin 45 = \sqrt{2}$ (m s^{-1}).	A1	1.1b	
	Use of suvat equations.	M1	3.1a	
	$x = \sqrt{2}t$	A1	1.1b	
	$y = \sqrt{2}t - 5t^2$	A1	1.1b	
	Max occurs when $\frac{dy}{dt} = 0$	M1	2.4	
	$t = \frac{\sqrt{2}}{10}$ (s)	A1	1.1b	
	then $x = 0.2$ (m)	A1	1.1b	
	and $y = 0.1$ (m)	A1	1.1b	
		(10)		
6.2b	Max height when hits wall.	M1	3.1b	8th Solve problems in unfamiliar contexts involving projectile motion.
	Solve for t.	M1	1.1b	
	$t = \frac{1}{10\sqrt{2}}$	A1	1.1b	
	Substitute t into y.	M1	1.1b	
	$y = 0.075$ m $= 7.5$ cm	A1	3.2a	
		(5)		
6.2c	Any valid limitation. For example, the ball bounces off the wall.	B1	3.5b	3rd Understand assumptions common in mathematical modelling.
		(1)		
				(16 marks)

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
7.2a	No net force means $\mathbf{F}_3 = -(\mathbf{F}_1 + \mathbf{F}_2) = -\begin{pmatrix}2\\0\end{pmatrix} - \begin{pmatrix}3\\0\end{pmatrix} = \begin{pmatrix}-5\\0\end{pmatrix}$	**M1**	1.1b	4th Calculate resultant forces using vectors.
	So $f = -5$	**A1**	2.2a	
		(2)		
7.2b	Use of moment = force × perpendicular distance from pivot.	**M1**	1.1a	5th Find resultant moments by considering direction.
	Moment = 2 × 1 + 3 × 3 + 5 × 3	**M1**	1.1b	
	= 26 N cm	**A1ft**	1.1b	
	= 0.26 N m	**A1ft**	1.1b	
		(4)		
				(6 marks)

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
8.1a	Integrate **v** w.r.t. time	**M1**	1.1a	8th Solve general kinematics problems using calculus of vectors.
	$\mathbf{r} = \frac{1}{2}t^2\mathbf{i} + t^3\mathbf{j} + \mathbf{C}$ (Allow omission of **C**)	**A1**	1.1b	
	$\mathbf{r} = \left(\frac{1}{2}t^2 + 1\right)\mathbf{i} + t^3\mathbf{j}$	**A1**	1.1b	
		(3)		
8.1b	Differentiate **v** w.r.t. time	**M1**	1.1a	8th Solve general kinematics problems using calculus of vectors.
	$\mathbf{a} = \mathbf{i} + 6t\mathbf{j}$	**A1**	1.1b	
	Substitute $t = 4$ into **a**	**M1**	1.1b	
	When $t = 4$, $\mathbf{a} = \mathbf{i} + 24\mathbf{j}$ (m s^{-2})	**A1**	1.1b	
		(4)		
8.1c	**j** component is 1 when $t = 1$	**M1**	3.1a	8th Solve general kinematics problems in a range of contexts using vectors.
	When $t = 1$, $\mathbf{r} = \frac{3}{2}\mathbf{i} + \mathbf{j}$ (m)	**A1**	1.1b	
		(2)		
				(9 marks)