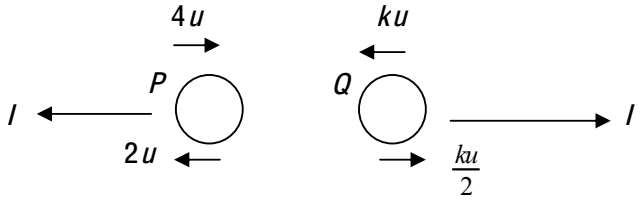
WME01/01: Mechanics M1

Question Number	Scheme	Marks
Q1	$(-4\mathbf{i}-7\mathbf{j})=\mathbf{r}+4(-3\mathbf{i}+2\mathbf{j})$ $\mathbf{r}=(8\mathbf{i}-15\mathbf{j})$ $\lvert\mathbf{r}\rvert=\sqrt{8^2+(-15)^2}=17$ m	M1 A1 A1 M1 A1 ft **[5]**
Q2 **(a)**	 $4mu-3mku=-2mu+3mk\frac{u}{2}$ $k=\frac{4}{3}$	M1 A1 M1 A1cso (4)
(b)	For P, $I=m(2u--4u)$ $=6mu$ **OR** For Q, $I=3m(\frac{ku}{2}--ku)$	M1 A1 A1 (3) **(M1A1)** **[7]**
Q3	$(\rightarrow)$ $100\cos30=F$ $F=0.5R$ *seen* $(\downarrow)$ $mg+100\cos60=R$ $m=13$ kg or 12.6 kg	M1 A1 A1 **(B1)** M1 A1 **DM1** A1 **[7]**

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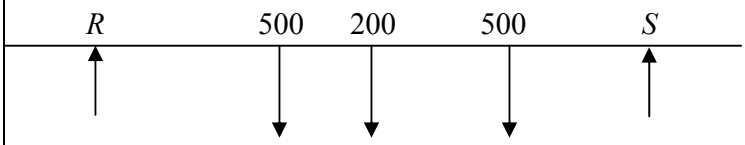
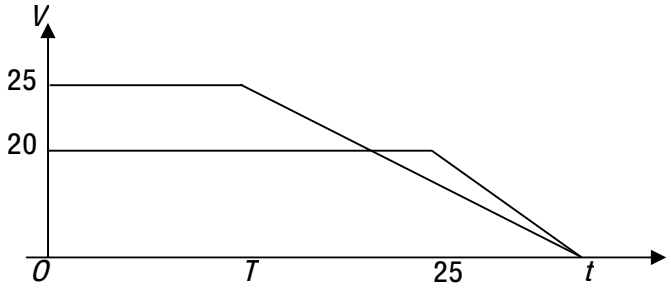
WME01/01: Mechanics M1

Question Number	Scheme	Marks
Q4	 $M(B)$, $500x + 500.2x + 200\text{x}3 = R\text{x}5 + S\text{x}1$ (or any valid moments equation) $(\downarrow)\ R + S = 500 + 500 + 200 = 1200$ (or a moments equation) solving for x; $x = 1.2$ m	 M1 A1 A1 M1 A1 M1 A1 cso **[7]**
Q5 (a)	 Shape (both) Cross Meet on t-axis 25,20,T,25 Figures	B1 B1 B1 B1 (4)
(b)	For Q: $20\left[\frac{t+25}{2}\right] = 800$ $t = 55$ For P: $25\left[\frac{T+55}{2}\right] = 800$ solving for T: $T = 9$	M1 A1 **DM1** A1 M1 A1 **DM1** A1 (8) **[12]**

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WME01/01: Mechanics M1

Question Number		Scheme	Marks
Q6	(a)	$(\uparrow) v^2 = u^2 + 2as$	
		$0 = 14.7^2 - 2\text{x } 9.8 \text{ x } s$	M1A1
		$s = 11.025$ (or 11 or 11.0 or 11.03) m	A1
		Height is 60 m or 60.0 m **ft**	A1ft (4)
	(b)	$(\downarrow) v^2 = u^2 + 2as$	
		$v^2 = (-14.7)^2 + 2\text{x } 9.8 \text{ x } 49$	M1 A1
		$v = 34.3$ or 34 m s^{-1}	A1 (3)
	(c)	$(\downarrow) v = u + at$ **OR** $(\downarrow) s = ut + \frac{1}{2}at^2$	
		$34.3 = -14.7 + 9.8t$ $\quad$ $49 = -14.7t + 4.9t^2$	M1 A1
		$t = 5$ $\quad$ $t = 5$	A1 (3)
			[10]
Q7	(a)	$F = \frac{1}{3}R$	B1
		$(\uparrow)\ R\cos\alpha - F\sin\alpha = 0.4g$	M1 A1
		$R = \frac{2}{3}g = 6.53$ or 6.5	M1 A1 (5)
	(b)	$(\rightarrow) P - F\cos\alpha - R\sin\alpha = 0$	M1 A2
		$P = \frac{26}{45}g = 5.66$ or 5.7	M1 A1 (5)
			[10]

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Question Number	Scheme	Marks
Q8 (a) Mark together	$(\downarrow) 0.4g - T = 0.4a$ $(\uparrow) T - 0.3g = 0.3a$ solving for T $T = 3.36$ or 3.4 or $12g/35$ (N)	M1 A1 M1 A1 **DM1** A1 (6)
(b)	$0.4g - 0.3g = 0.7a$ $a = 1.4$ m s^{-2}, $g/7$	**DM1** A1 (2)
(c)	$(\uparrow) v = u + at$ $v = 0.5$ x 1.4 $= 0.7$	 M1 A1 ft on a
	$(\uparrow) s = ut + \frac{1}{2}at^2$ $s = 0.5$ x 1.4 x 0.5^2 $= 0.175$	 M1 A1 ft on a
	$(\downarrow) s = ut + \frac{1}{2}at^2$ $1.175 = -0.7t + 4.9t^2$ $4.9t^2 - 0.7t - 1.175 = 0$ $t = \frac{0.7 \pm \sqrt{0.7^2 + 19.6 \text{ x } 1.175}}{9.8}$ $= 0.5663..$ or $-...$	 **DM1** A1 ft **DM1** A1 cao
	Ans 0.57 or 0.566 s	A1 cao (9) **[17]**

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