Question 1 Jan 05 Q5

Question Number	Scheme	Marks
5	(a) '$s = ut + \frac{1}{2}at^2$' for B: $0.4 = \frac{1}{2}a(0.5)^2$	M1 A1
	$a = \underline{3.2 \text{ m s}^{-2}}$	A1 (3)
	(b) N2L for B: $0.8g - T = 0.8 \times 3.2$	M1 A1√ ↓
	$T = \underline{5.28 \text{ or } 5.3 \text{ N}}$	M1 A1 (4)
	(c) Same acceleration for A and B.	B1 (1)

Question Number	Scheme		Marks	
	(a) $s = ut + \frac{1}{2}at^2 \Rightarrow 3.15 = \frac{1}{2}a \times \frac{9}{4}$		M1 A1	
	$\qquad a = 2.8 \ \left(ms^{-2}\right)$ ∗	cso	A1	(3)
	(b) N2L for P: $\quad 0.5g - T = 0.5 \times 2.8$		M1 A1	
	$\qquad T = 3.5 \ (N)$		A1	(3)
	(c) N2L for Q: $\quad T - mg = 2.8m$		M1 A1	
	$\qquad m = \dfrac{3.5}{12.6} = \dfrac{5}{18}$ ∗	cso	DM1 A1	(4)
	(d) The acceleration of P is equal to the acceleration of Q.		B1	(1)
	(e) $\qquad v = u + at \Rightarrow v = 2.8 \times 1.5$		M1 A1	
	$\quad$ (or $\quad v^2 = u^2 + 2as \Rightarrow v^2 = 2 \times 2.8 \times 3.15$)			
	$\qquad \left(v^2 = 17.64, v = 4.2\right)$			
	$\quad v = u + at \Rightarrow 4.2 = -4.2 + 9.8t$		DM1 A1	
	$\qquad t = \dfrac{6}{7}, 0.86, 0.857 \ (s)$		DM1 A1	(6)
				[17]

Question Number	Scheme	Marks	
(a)	B: $2mg - T = 2m \times 4g/9$	M1 A1	
	$\Rightarrow T = \underline{10mg/9}$	A1	(3)
(b)	When B hits: $v^2 = 2 \times 4g/9 \times h$	M1 A1	
	Deceleration of A after B hits: $ma = \mu mg \Rightarrow a = 2g/3$	M1 A1 f.t.	
	Speed of A at P: $V^2 = 8gh/9 - 2 \times 2g/3 \times h/3$	DM1	
	$\Rightarrow V = \frac{2}{3}\sqrt{(gh)}$	A1	(6)
(c)	Same tension on A and B	B1	(1)
			15

Question Number	Scheme		Marks
	(a) N2L A: $\quad 5mg - T = 5m \times \dfrac{1}{4}g$		M1 A1
	$\qquad\qquad T = \dfrac{15}{4}mg$ ✱ $\qquad\qquad\qquad$ cso		A1 $\qquad$ (3)
	(b) N2L B: $\quad T - kmg = km \times \dfrac{1}{4}g$		M1 A1
	$\qquad\qquad k = 3$		A1 $\qquad$ (3)
	(c) The tensions in the two parts of the string are the same		B1 $\qquad$ (1)
	(d) Distance of A above ground $\quad s_1 = \dfrac{1}{2} \times \dfrac{1}{4}g \times 1.2^2 = 0.18g \ (\approx 1.764)$		M1 A1
	$\quad$ Speed on reaching ground $\qquad v = \dfrac{1}{4}g \times 1.2 = 0.3g \ (\approx 2.94)$		M1 A1
	$\quad$ For B under gravity $\quad (0.3g)^2 = 2gs_2 \quad \Rightarrow \quad s_2 = \dfrac{(0.3)^2}{2}g \ (\approx 0.441)$		M1 A1
	$\qquad\qquad S = 2s_1 + s_2 = 3.969 \approx 4.0 \ (m)$		A1 $\qquad$ (7)
			[14]

Question 5 June 10 Q8

Question Number	Scheme	Marks
(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)	$0.4g - 0.3g = 0.7a$ $a = 1.4 \text{ m s}^{-2}, g/7$	DM1 A1 (2)
(c)	$(\uparrow)v = u + at$ $v = 0.5 \times 1.4$ $= 0.7$ $(\uparrow)s = ut + \frac{1}{2}at^2$ $s = 0.5 \times 1.4 \times 0.5^2$ $= 0.175$ $(\downarrow)s = ut + \frac{1}{2}at^2$ $1.175 = -0.7t + 4.9t^2$ $4.9t^2 - 0.7t - 1.175 = 0$ $t = \dfrac{0.7 \pm \sqrt{0.7^2 + 19.6 \times 1.175}}{9.8}$ $= 0.5663..$ or $-...$ Ans 0.57 or 0.566 s	 M1 A1 ft on a M1 A1 ft on a DM1 A1 ft DM1 A1 cao A1 cao (9) [17]