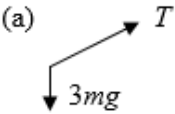
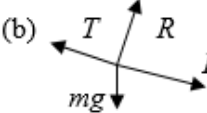


Connected Particles - Edexcel Past Exam Questions MARK SCHEME

Question 1: Jan 05 Q5

Question Number	Scheme	Marks
	(a) 's = ut + ½at ² ' for B: $0.4 = \frac{1}{2} a(0.5)^2$ $a = \underline{3.2 \text{ m s}^{-2}}$	M1 A1 A1 (3)
	(b) N2L for B: $0.8g - T = 0.8 \times 3.2$ $T = \underline{5.28 \text{ or } 5.3 \text{ N}}$	M1 A1√ ↓ M1 A1 (4)
	(c) A: $F = \mu \times 0.5g$ N2L for A: $T - F = 0.5a$ Sub and solve $\mu = \underline{0.75 \text{ or } 0.751}$	B1 M1 A1 ↓ M1 A1 (5)
	(d) Same acceleration for A and B.	B1 (1)

Question 2: Jan 06 Q7

Question Number	Scheme	Marks
	<p>(a)  A: $3mg \sin 30 - T = 3m \cdot \frac{1}{10}g$ $\Rightarrow T = \frac{6}{5}mg$</p> <p>(b)  F: R(perp): $R = mg \cos 30$ R(//): $T - mg \sin 30 - F = m \cdot \frac{1}{10}g$ Using $F = \mu R$ $\frac{6}{5}mg - \frac{1}{2}mg - \mu mg \frac{\sqrt{3}}{2} = \frac{1}{10}mg$ $\rightarrow \mu = \underline{0.693 \text{ or } 0.69 \text{ or } \frac{2\sqrt{3}}{5}}$</p> <p>(c)  Magn of force on pulley = $2T \cos 60 = \frac{6}{5}mg$ Direction is vertically downwards</p>	<p>M1 A1 A1 (3)</p> <p>M1 A1 M1 A2, 1, 0 M1 ↓↓↓ M1 A1 (8)</p> <p>M1 A1 ✓ B1 (cso) (3)</p> <p>14</p>



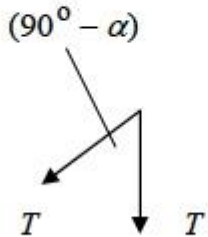
Question 3 : Jan 07 Q7

Question Number	Scheme	Marks
(a)	N2L Q $2g - T = 2a$ N2L P $T - 3g \sin 30^\circ = 3a$	M1 A1 M1 A1 <u>4</u>
(b)	$2g - 3g \sin 30^\circ = 5a$ $a = 0.98 \text{ (ms}^{-2}\text{)} \star$ cso	M1 A1 <u>2</u>
(c)	$T = 2(g - a)$ or equivalent $\approx 18 \text{ (N)}$ accept 17.6	M1 A1 <u>2</u>
(d)	The (magnitudes of the) accelerations of P and Q are equal	B1 <u>1</u>
(e)	$v^2 = u^2 + 2as \Rightarrow v^2 = 2 \times 0.98 \times 0.8 \text{ (=1.568)}$ $v \approx 1.3 \text{ (ms}^{-1}\text{)}$ accept 1.25	M1 A1 <u>2</u>
(f)	N2L for P $-3g \sin 30^\circ = 3a$ $a = (-)\frac{1}{2}g$ $s = ut + \frac{1}{2}at^2 \Rightarrow 0 = \sqrt{1.568t - \frac{1}{2}4.9t^2}$ or equivalent $t = 0.51 \text{ (s)}$ accept 0.511	M1 A1 M1 A1 A1 <u>5</u> 16
<i>A maximum of one mark can be lost for giving too great accuracy.</i>		

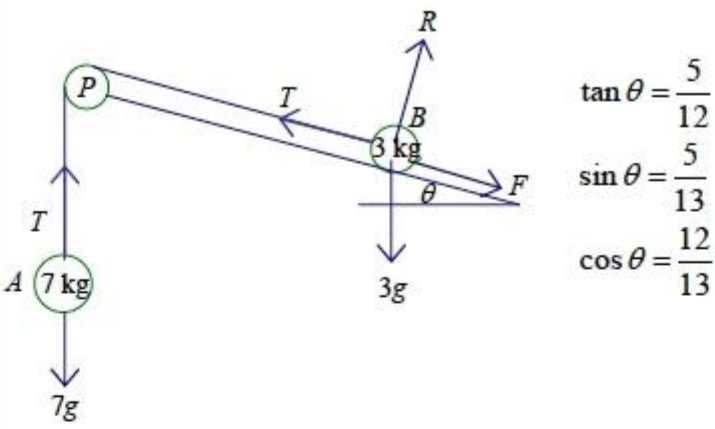
Question 4: Jan 08 Q7

Question Number	Scheme	Marks
(a)	$B: \quad 2mg - T = 2m \times 4g/9$ $\Rightarrow T = \underline{10mg/9}$	M1 A1 A1 (3)
(b)	$A: \quad T - \mu mg = m \times 4g/9$ Sub for T and solve: $\mu = 2/3$ *	M1 B1 A1 DM1 A1 (5)
(c)	When B hits: $v^2 = 2 \times 4g/9 \times h$ Deceleration of A after B hits: $ma = \mu mg \Rightarrow a = 2g/3$ Speed of A at P : $V^2 = 8gh/9 - 2 \times 2g/3 \times h/3$ $\Rightarrow V = \frac{2}{3} \sqrt{gh}$	M1 A1 M1 A1 f.t. DM1 A1 (6)
(d)	Same tension on A and B	B1 (1) 15

Question 5: Jan 09 Q7

Question Number	Scheme	Marks
(a)	$T - 5g \sin \alpha = 5a$ $15g - T = 15a$ solving for a $a = 0.6g$ solving for T $T = 6g$	M1 A1 M1 A1 M1 A1 M1 A1 (8)
(b)	For Q : $5g - N = 5a$ $N = 2g$	M1 A1 A1 f.t. (3)
(c)	 $F = 2T \cos\left(\frac{90^\circ - \alpha}{2}\right)$ $= 12g \cos 26.56^\circ$ $= 105 \text{ N}$	M1 A2 A1 f.t. A1 (5) [16]

Question 6: Jan 11 Q7

Question Number	Scheme	Marks
(a)	 <p> $\tan \theta = \frac{5}{12}$ $\sin \theta = \frac{5}{13}$ $\cos \theta = \frac{12}{13}$ </p> <p> For A: $7g - T = 7a$ For B: parallel to plane $T - F - 3g \sin \theta = 3a$ perpendicular to plane $R = 3g \cos \theta$ $F = \mu R = 3g \cos \theta = 2g \cos \theta$ </p> <p> Eliminating T, $7g - F - 3g \sin \theta = 10a$ Equation in g and a: $7g - 2g \times \frac{12}{13} - 3g \frac{5}{13} = 7g - \frac{39}{13}g = 4g = 10a$ $a = \frac{2g}{5}$ oe or 3.9 or 3.92 </p>	M1 A1 M1 A1 M1 A1 M1 DM1 DM1 A1 (10)
(b)	After 1 m, $v^2 = u^2 + 2as$, $v^2 = 0 + 2 \times \frac{2g}{5} \times 1$ $v = 2.8$	M1 A1 (2)
(c)	$-(F + 3g \sin \theta) = 3a$ $\frac{2}{3} \times 3g \times \frac{12}{13} + 3g \times \frac{5}{13} = 3g = -3a$, $a = -g$ $v = u + at$, $0 = 2.8 - 9.8t$, $t = \frac{2}{9.8}$ oe, 0.29. 0.286	M1 A1 DM1 A1 (4) [16]



Question 7: June 11 Q6

Question Number	Scheme	Marks
(a)	$R = 0.3g \cos \alpha$ $= 0.24g = 2.35 \text{ (3sf)} = 2.4 \text{ (2sf)}$	M1 A1 (2)
(b)	$mg - T = 1.4m$ $T - 0.3g \sin \alpha - F = 0.3 \times 1.4$ $F = 0.5R$ Eliminating R and T $m = 0.4$	M1 A1 M1 A2 M1 DM1 A1 (8)
(c)	$v = 1.4 \times 0.5$ $-0.3g \sin \alpha - F = 0.3a$ $a = -9.8$ $0 = 0.7 - 9.8t$ $t = 0.071 \text{ s or } 0.0714 \text{ s (1/14 A0)}$	B1 M1 A1 A1 M1 A1 (6) 16