GCE 2005

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ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics

MM1A/W

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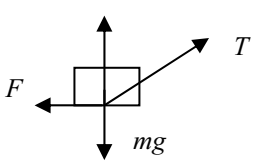
MM1A/W

Q	Solution	Marks	Total	Comments
1(a)(i)	$40 = 12 + 100a$	M1		Use of a constant acceleration equation to form equation for a
	$a = \dfrac{40-12}{100} = 0.28 \text{ ms}^{-2}$ AG	A1	2	AG; correct answer from correct working
(ii)	$s = \dfrac{1}{2}(12+40)\times 100$	M1		Expression for distance, using t =100
	$= 2600 \text{ m}$	A1	2	Correct final distance
(c)	$F - 40000 = 200\times 1000\times 0.28$	M1		Three term equation of motion
		A1		Correct equation
	$F = 40000 + 56000 = 96000 \text{ N}$	A1	3	Correct force
	Total		**7**	
2(a)	$12\begin{bmatrix}4\\7\end{bmatrix} + 4\begin{bmatrix}2\\3\end{bmatrix} = 16\mathbf{v}$	M1		Three term momentum equation
		A1		Correct equation
	$\mathbf{v} = \dfrac{1}{16}\begin{bmatrix}56\\96\end{bmatrix} = \begin{bmatrix}3.5\\6.0\end{bmatrix} \text{ ms}^{-1}$	m1		Solving for **v**
		A1	4	Correct velocity
(b)	$12\begin{bmatrix}4\\7\end{bmatrix} + 4\mathbf{u} = 16\begin{bmatrix}1\\4\end{bmatrix}$	M1		Three term momentum equation
		A1		Correct equation
	$\mathbf{u} = \dfrac{1}{4}\begin{bmatrix}-32\\-20\end{bmatrix} = \begin{bmatrix}-8\\-5\end{bmatrix} \text{ ms}^{-1}$	A1	3	Correct velocity
	Total		**7**	
3 (a)		B1	1	Correct diagram
(b)	$40\cos 30° - F = 25\times 0.1$	M1		Three term equation of motion
		A1		Correct equation
	$F = 40\cos 30° - 2.5 = 32.1 \text{ N}$	A1	3	AG; correct force from correct working
(c)	$R + 40\sin 30° = 25\times 9.8$	M1		Resolving vertically
		A1		Correct equation
	$R = 225 \text{ N}$	A1	3	AG; correct force from correct working
(d)	$32.1 = 225\mu$	M1		use of $F = \mu R$
	$\mu = \dfrac{32.1}{225} = 0.143$	A1	2	Correct μ
	Total		**9**	

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MM1A/W (cont)

Q	Solution	Marks	Total	Comments
4(a)	$F = 0.8\times 8\times 9.8 = 62.72$ N	M1 A1	 2	Use of $F = \mu R$ with R = 8 ×9.8 Correct F
(b)	$7g - T = 7a$ $T - 62.72 = 8a$ $7g - 62.72 = 15a$ $a = \dfrac{7g - 62.72}{15} = 0.392$	M1 A1 M1 A1 A1	 5	Three term equation of motion for one particle Correct equation Three term equation of motion for other particle Correct equation AG; correct a from correct working
	Total		**7**	
5(a)(i)	$30\sin 60°t - 4.9t^2 = 0$ $t = \dfrac{30\sin 60°}{4.9} = 5.302$ AG	M1 A1 A1	 3	Expression for height equal to zero Correct expression AG; correct conclusion from correct working
(ii)	$s = 30\cos 60°\times 5.302 = 79.5$ m	M1 A1	 2	Use of horizontal component of velocity to find the range Correct range
(b)	$30\sin 60°t - 4.9t^2 = 5$ $4.9t^2 - 30\sin 60°t + 5 = 0$ $t = 0.200$ or 5.102 $s = 30\cos 60°\times 5.102 = 76.5$ m	M1 A1 A1 m1 A1 A1	 6	Expression for height equal to 5 Correct LHS Correct RHS Solving a quadratic equation Correct solutions Correct distance
	Total		**11**	
6(a)	$\dfrac{\sin 60°}{6} = \dfrac{\sin\alpha}{2}$ $\alpha = 16.8°$	M1 A1 A1 A1	 4	Use of sine rule Correct LHS Correct RHS AG; correct α from correct working
(b)	$\dfrac{v}{\sin(180-60-16.8)} = \dfrac{6}{\sin 60°}$ $v = 6.74$ or 6.75 ms^{-1}	M1 A1 A1	 3	use of sine rule to find v Correct equation Correct v
	Total		**7**	

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MM1A/W (cont)

Q	Solution	Marks	Total	Comments
7 (a)	$-\mathbf{i}+\mathbf{j}=2\mathbf{i}-\mathbf{j}+10\mathbf{a}$	M1		Use of velocity equation
		A1		Correct equation
	$\mathbf{a}=-0.3\mathbf{i}+0.2\mathbf{j}$	A1	3	Correct **a**
(b)	$\mathbf{r}=(2\mathbf{i}-\mathbf{j})t+\frac{1}{2}(-0.3\mathbf{i}+0.2\mathbf{j})t^2+20\mathbf{i}$	M1		Use of constant acceleration equation for position
		A1		Correct **i** component
	$=\left(2t-0.15t^2+20\right)\mathbf{i}+\left(-t+0.1t^2\right)\mathbf{j}$	A1ft	3	Correct **j** component ft incorrect acceleration
(c) (i)	$\mathbf{r}(20)=(2\times20-0.15\times20^2+20)\mathbf{i}+(-20+0.1\times20^2)\mathbf{j}$	M1		Substituting $t = 20$ into their expression for **r**
	$=0\mathbf{i}+20\mathbf{j}$			
	so due north of origin	A1	2	Correct conclusion from correct working
(c)(ii)	$\mathbf{v}(20)=2\mathbf{i}-\mathbf{j}+20(-0.3\mathbf{i}+0.2\mathbf{j})$	M1		Finding velocity at $t = 20$
	$=-4\mathbf{i}+3\mathbf{j}$	A1		Correct velocity
		m1		Finding magnitude
	$\mathbf{v}(20)=\sqrt{4^2+3^2}=5\ \text{ms}^{-1}$	A1ft	4	Correct speed ft incorrect acceleration
	Total		**12**	
	TOTAL		**60**	

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