

GCE 2005

January Series



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Mark Scheme

Mathematics

MM1A/W

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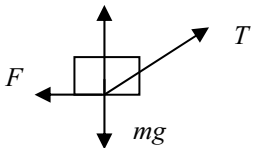
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Dr Michael Cresswell Director General

MM1A/W

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

MM1A/W (cont)

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

MM1A/W (cont)

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