GCE 2004 November Series



Mark Scheme

Mathematics A (MAM1/W)

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Key to Mark Scheme

M	mark is for	method
m	mark is dependent on one	or more M marks and is for method
A	mark is dependent on M of	m marks and is foraccuracy
B	mark is independent of M	or m marks and is formethod and accuracy
E	mark is for	explanation
\checkmark or ft or F		follow through from previous
		incorrect result
CAO		correct answer only
AWFW		anything which falls within
AWRT		anything which rounds to
AG		answer given
SC		special case
OE		or equivalent
A2,1		
- <i>x</i> EE		deduct <i>x</i> marks for each error
NMS		no method shown
PI		possibly implied
SCA		substantially correct approach
c		candidate
SF		significant figure(s)
DP		decimal place(s)

Abbreviations used in Marking

MC – <i>x</i>	
MR – <i>x</i>	
ISW	
BOD	
WR	
FB	

Application of Mark Scheme

No method shown: Correct answer without working Incorrect answer without working	
More than one method/choice of solution: 2 or more complete attempts, neither/none crossed out 1 complete and 1 partial attempt, neither crossed out	mark both/all fully and award the mean mark rounded down award credit for the complete solution only
Crossed out work	do not mark unless it has not been replaced
Alternative solution using a correct or partially correct method	award method and accuracy marks as appropriate

MAM1/W

1(a) $a = change in velocity / time orv = u + ata = 2 m s^{-2}M1used(b)distance = \frac{1}{2} \times 5 \times 6M1A1F2(b)distance = \frac{1}{2} \times 5 \times 6M1A1F3(c)acceleration not likely to be constantinitial acceleration unrealisticchange in velocity at t = 3 will besmootherB111Total62\bigvee_{O_A} = \frac{2}{O_B}I62\bigvee_{O_A} = \frac{2}{O_B}II3mv + 2m = 4m \times 1.51.5M1A1A13(a)3mv + 2m = 4m \times 1.5v = \frac{4}{3}M1A1A13(b)v^2 = u^2 + 2as0 = (1.5)^2 + 2 \times a \times 3retardation = 0.375m s^{-2}M1A1A13(b)v^2 = a^2 + 2as0 = (1.5)^2 + 2 \times a \times 3retardation = 0.375m s^{-2}M1A1A1Sum of vertical forces = zeroA13(a)Sum of vertical forces = zeroq = 6M1A1M1A1AA1W1 for equation, 3 forcescao(b)horizontal:R = 3 + 8 \cos 30^\circ - 4 \cos 30^\circR = 6.46 \text{ or } 6.47TT$	Q	Solution	Marks	Total	Comments
$a = 2 \text{ m s}^{-2}$ A12(b)distance $= \frac{1}{2} \times 5 \times 6$ M1 A1FFull method15 metresA1F3(c)acceleration not likely to be constant initial acceleration nurealistic change in velocity at $t = 3$ will be smootherB11 \mathbf{v} $\frac{2}{\bigcirc_{A}}$ $\frac{2}{\bigcirc_{B}}$ \mathbf{b} (a) $3mv + 2m = 4m \times 1.5$ $v = \frac{4}{3}$ M1A1 A13(b) $v^2 = u^2 + 2as$ $0 = (1.5)^2 + 2 \times a \times 3$ M1A1 M1A1 A1Full method, accept \pm (a) $3mv + 2m = 4m \times 1.5$ $v = \frac{4}{3}$ M1A1 A13(b) $v^2 = u^2 + 2as$ $0 = (1.5)^2 + 2 \times a \times 3$ $retardation = 0.375 \text{ ms}^{-2}$ M1A1 A1Full method, accept \pm (a)Sum of vertical forces $- zero$ $4 \cos 60^\circ + 8 \cos 60^\circ - q = 0$ $q = 6$ M1 A1 A1Magnitude required(b)horizontal: $R = 3 + 8 \cos 30^\circ - 4 \cos 30^\circ$ $R = 6.46 \text{ or } 6.47$ M1A1 A1FA	1(a)	a = change in velocity / time or	M1		used
(b) distance = $\frac{1}{2} \times 5 \times 6$ 15 metres A1F 3 (c) acceleration not likely to be constant initial acceleration unrealistic change in velocity at $t = 3$ will be smoother B1 1 Total B1 1 $v \rightarrow d$ D1 1 2 $v \rightarrow d$ 1 2 $v \rightarrow $		v = u + at			
AIFAIF15 metresAIF3acceleration not likely to be constant initial acceleration unrealistic change in velocity at $t = 3$ will be smootherB1162 $\stackrel{V}{\rightarrow}_{A}$ $\stackrel{Q}{\rightarrow}_{A}$ $\stackrel{Q}{\rightarrow}_{B}$ $\stackrel{Q}{\rightarrow}_{A}$ $\stackrel{MIA1}{A1}$ $\stackrel{Q}{\rightarrow}_{A}$		$a = 2 \mathrm{m s}^{-2}$	A1	2	
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initial acceleration unrealistic change in velocity at $t = 3$ will be smoother Total Total Total Total B1 1 B1		acceleration not likely to be constant			
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smootherB11Total62 $v \rightarrow 2$ \overrightarrow{O}_A 2 $v \rightarrow 3$ \overrightarrow{O}_B \overrightarrow{I}_A \overrightarrow{O}_A \overrightarrow{O}_B \overrightarrow{O}_B \overrightarrow{O}_A \overrightarrow{O}_B \overrightarrow{O}_A \overrightarrow{O}_A \overrightarrow{O}_B <t< th=""><th></th><th></th><th></th><th></th><th></th></t<>					
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1.5 M1A1 3mv + 2m = 4m × 1.5 M1A1 $v = \frac{4}{3}$ A1 (b) $v^2 = u^2 + 2as$ $0 = (1.5)^2 + 2 × a × 3$ M1A1 retardation = 0.375 m s^{-2} A1 3(a) Sum of vertical forces = zero $4 \cos 60^\circ + 8 \cos 60^\circ - q = 0$ M1 A1 $q = 6$ M1 A1 $q = 6$ A1 4cos 60^\circ + 8 cos 60^\circ - q = 0 M1 A1 $q = 6$ A1 4cos 60^\circ + 8 cos 30^\circ - q = 0 M1 A1 $q = 6$ A1 4cos 60^\circ + 8 cos 30^\circ - 4 cos 30^\circ M1A1 $R = 3 + 8 cos 30^\circ - 4 cos 30^\circ$ M1A1 $R = 6.46$ or 6.47 A1F					
$v = \frac{4}{3}$ A1 3 (b) $v^2 = u^2 + 2as$ M1A1 Full method, accept ± $0 = (1.5)^2 + 2 \times a \times 3$ M1A1 Full method, accept ± retardation = 0.375 m s^{-2} A1 3 Magnitude required 6 6 6 3(a) Sum of vertical forces = zero M1 used $4 \cos 60^\circ + 8 \cos 60^\circ - q = 0$ M1 A1 M1 for equation, 3 forces $q = 6$ A1 4 cao (b) horizontal: $R = 3 + 8 \cos 30^\circ - 4 \cos 30^\circ$ M1A1 $R = 3$ $R = 6.46$ or 6.47 A1F 3 A A A		1.5			
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(b) horizontal: $R = 3 + 8 \cos 30^\circ - 4 \cos 30^\circ$ M1A1 R = 6.46 or 6.47 A1F 3		$4\cos 60^{\circ} + 8\cos 60^{\circ} - q = 0$	M1 A1		M1 for equation, 3 forces
$R = 3 + 8\cos 30^\circ - 4\cos 30^\circ$ M1A1 $R = 6.46$ or 6.47 A1F		q = 6	A1	4	cao
$R = 3 + 8\cos 30^\circ - 4\cos 30^\circ$ M1A1 $R = 6.46$ or 6.47 A1F	ക	horizontal			
R = 6.46 or 6.47 A1F 3	(U)		MIAI		
				3	
		Total	AIF		

MAM1/W (cont)

Q	Solution	Marks	Total	Comments
4(a)	$\mathbf{r} = \int (4\mathbf{i} - 2t\mathbf{j}) \mathrm{d}t$	M1		attempted
	$= 4t\mathbf{i} - t^2\mathbf{j} \qquad (+c)$	A1		
	$t = 0, \mathbf{r} = 8\mathbf{j}$	m1		used
	$= 4t\mathbf{i} - t^{2}\mathbf{j} (+c)$ $t = 0, \ \mathbf{r} = 8\mathbf{j}$ $\mathbf{r} = 4t\mathbf{i} + (8-t^{2})\mathbf{j}$	A1F	4	
(b)	$t = 2, \mathbf{r} = 8\mathbf{i} + 4\mathbf{j}$	B1F	1	
(c)	$8 - t^2 = 0$	M1		
	$t = 2\sqrt{2}$ or $t = 2.83$	A1	2	
	Total		7	
5 (a)	$\mathbf{v}_1 = 5\mathbf{i} - 6\mathbf{j}$	B1	1	
(b)(i)	$\mathbf{v}_2 = -5\mathbf{i} + 6\mathbf{j}$	B1F	1	
(ii)	$-5\mathbf{i} + 6\mathbf{j}$ $D = 3\mathbf{i}$	B1F		Diagram possibly implied
		M1		
	$\mathbf{v} = -8\mathbf{i} + 6\mathbf{j}$	A1F		
	- 10 m - ⁻	M1		
	$ \mathbf{v} = 10 \mathrm{m s^{-1}}$	A1F	5	
	Total		7	

MAM1/W (cont)

Q	Solution	Marks	Total	Comments
6(a)(i)	<i>B</i> : $T = mg = 0.1 \times 9.8 = 0.98$ N	B1	1	cao
(ii)	$A: F = T(=0.98)$ $R = 0.5 \times 9.8$	B1		~
	$\mu \times 0.5 \times 9.8 = 0.98$	M1	2	Condone inequality
	$\mu = 0.2$	A1	3	cao
(iii)		B1	1	Must label T or 0.98 N
(iv)	R T T T			
	$R = \sqrt{(T^2 + T^2)}$ or $2T \cos 45^\circ$	M1		
	R = 1.39N	A1	2	
(b)(i)	<i>A</i> : $T - 0.98 = 0.5a$	M1A1		Either equation for M1
	<i>B</i> : $2 \times 0.1 \times 9.8 - T = 0.2a$	A1		
	0.98 = 0.7a	m1		
	a = 1.4	A1	5	cao
(ii)	$T = 0.98 + 0.5 \times 1.4, \qquad T = 1.68$	A1F	1	ft accuracy error in equation
(iii)	$s = ut + \frac{1}{2}at^{2}$ 0.7 = 0 + $\frac{1}{2} \times 1.4t^{2}$			
	$0.7 = 0 + \frac{1}{2} \times 1.4t^2$	M1		
	<i>t</i> = 1	A1	2	
	Total		15	

3 3	
MAM1/W	(cont)

Q	Solution	Marks	Total	Comments
7(a)(i)	vertical: $s = ut + \frac{1}{2}at^2$			
	$0 = 7t - 4.9t^{2}$ 0 = t (7 - 4.9t)	M1		Full method
	0 = 7 - 4.9t	m1		
	$t = \frac{10}{7}$ sec (1.43)	A1	3	
(ii)	$OF = 21 \times \frac{10}{7}$	M1		
	= 30 m	A1F	2	
(b)	vert: $0 = 3.5t - 4.9t^2$	M1		Full method required
	$t = \frac{3.5}{4.9}$	ml		
	$FG = 21 \times \frac{3.5}{4.9}$	M1		
	= 15 m	A1	4	
(c)	$GH = \frac{1}{2} \times 15 = 7.5$	B1F		
	OH = 30 + 15 + 7.5	M1		
	= 52.5 m	A1F	3	
	Total		12	
	Total		60	