

GCE 2004

June Series



Mark Scheme

Mathematics A

Unit 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.

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Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
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Dr Michael Cresswell Director General

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 or m marks and is for accuracy
B.....mark is independent of M or m marks and is formethod and accuracy
E.....mark is for explanation
✓ 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..... 2 or 1 (or 0) accuracy marks
-x EE..... deduct x 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 – x..... deducted x marks for mis-copy
MR – x..... deducted x marks for mis-read
ISW..... ignored subsequent working
BOD..... given benefit of doubt
WR..... work replaced by candidate
FB..... formulae booklet

Application of Mark Scheme

No method shown:

Correct answer without working..... mark as in scheme
 Incorrect answer without working zero marks unless specified otherwise

More than one method/choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

Crossed out work

do not mark unless it has not been replaced

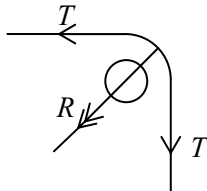
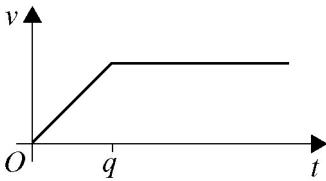
Alternative solution using a correct or partially correct method

award method and accuracy marks as appropriate

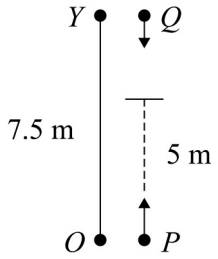
MAM1/W

Q	Solution	Marks	Total	Comments
1(a)	$v^2 = u^2 + 2as$	M1	3	Use of full method
	$0^2 = 3.5^2 + 2 \times a \times 2.5$	A1		Correct subs
	$a = -2.45$ mag 2.45	A1		Magnitude required
(b)(i)	Friction : $0.2 \times 2.45 = 0.49\text{N}$	M1A1	2	M1: use of $F = ma$ with ± 2.45 A1: Magnitude required
(ii)	$R = 0.2 \times g$			
	$F = \mu R$ $0.49 = \mu \times 0.2g$ $\mu = 0.25$	M1 A1F	2	Use of $F = \mu R$ with $R = mg$ substituted ft (i) provided μ positive Use of $F < \mu R$, M1 A0
Total			7	
2(a)	$\mathbf{v} = 6\mathbf{i} + 2t\mathbf{j}$	M1A1	2	M1: differentiation attempted and vector quantity for \mathbf{v} given
(b)	$sp = \sqrt{(6^2 + 4t^2)} \text{ ms}^{-1}$	M1A1F	2	M1: sum of squares attempted giving scalar expression A1: all correct, accept $(2t)^2$ ft \mathbf{v} with 2 components
(c)	$\sqrt{(6^2 + 4t^2)} = 6\sqrt{2}$	M1		o.e.; scalar expression for \mathbf{v} in terms of t from (b) used
	$36 + 4t^2 = 36 \times 2$ $t = 3$	A1F	2	ft minor slip in (b) provided t is positive solution of quadratic eqn
Total			6	
3(a)	$1200 - R = 1000 \times 0.25$	M1A1	3	M1: all relevant terms used
	$R = 950 \text{ N}$	A1F		ft one slip if $R > 0$
(b)	$2100 - 1000g \times 0.1 - 950 = 1000 \times a$	M1 A1A1		M1: 3 or 4 terms considered – 1 each term incorrect (any error), or missing, $\alpha = 5.74^\circ$
	$a = 0.17 \text{ ms}^{-2}$	A1F	4	ft one error if 4 terms considered
Total			7	

MAM1/W (Cont)

Q	Solution	Marks	Total	Comments
4(a)(i)	$T = 0.6a$	M1	5	Either equation (M1 A0 for use of $0.1ga$) SC whole string method: $0.1g = 0.7a$ M1A1 (total mass used) $a = 1.4$ A1, max 3/5)
	$0.1g - T = 0.1a$	A1 A1		
	$0.1g = 0.7a$	m1		
	$a = 1.4 \text{ ms}^{-2}$	A1		
(ii)	$T = 0.6 \times 1.4 = 0.84 \text{ N}$	A1	1	Dependent on M1 gained in (a), Or, s.c. can gain M1 (from (a)) A1 here if equations involving T not found in (a) Max M1 A1
(iii)		B1	3	recognising 2 tensions involved M1: attempt at Pythagoras or at a component of T A1: f.t. tension
		$R = 2T \cos 45^\circ$ $= 1.19 \text{ N}$		
(b)		B1	3	1 st line sloping and through O 2 nd line horizontal label at $t = q$
		B1		
		B1		
Total			12	

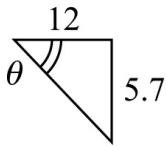
MAM1/W Cont)

Q	Solution	Marks	Total	Comments
5(a)(i)	 <p>7.5 m</p> <p>5 m</p> <p>Y ● Q</p> <p>O ● P</p> <p>Q: $s = ut + \frac{1}{2}at^2$</p> <p>$s = 0 + \frac{1}{2} \times 9.8 \times \frac{25}{49}$</p> <p>$s = 2.5$</p>	M1		M1: full method for s
(ii)	$5 + 2.5 = 7.5$ so collision occurs	A1	2	
(b)	<p>Q: $v = 0 + 9.8 \times \frac{5}{7}$</p> <p>$= 7$</p> <p>$\downarrow -0.2 \times 3.5 + 0.3 \times 7 = 0.5v$</p> <p>$v = 2.8 \downarrow$</p>	M1	1	M1: full method for v
		A1		
		M1A1F		M1: Momentum equation with 3 terms with appropriate masses. ft velocity of Q
		A1F		A1F for magnitude ft one minor slip in working
		A1	6	A1 for direction, (may be implied in answer given in vector form with negative component) SC B1 for $v = -2.8$
	Total		9	

MAM1/W (Cont)

Q	Solution	Marks	Total	Comments
6(a)	$y = \frac{120}{20} = 6\text{ms}^{-1}$	B1	1	
(b)		M1 A1		Triangle linking 3 velocities, with 1.2 easterly Correct configuration of velocities, with x east of north and $0 < \alpha < 30^\circ$ Must see x or y or α or 30°
(c)	north $6\cos 30^\circ (= 5.20)$ (5.196)	B1F	3	Arrows and labels of at least 2 sides Accept $y \cos 30^\circ$ and $y \sin 30^\circ$ seen anywhere, ft y if substituted
	east $6\sin 30^\circ (= 3)$	B1F	2	
(d)(i)	$x^2 = 1.8^2 + 5.196^2$	M1		Alt: use of cos rule $x^2 = 6^2 + 1.2^2 - 2 \times 6 \times 1.2 \times \cos 60^\circ$ $x = 5.499$
(ii)	$x = 5.50 \text{ km/h}$	A1	2	AWRT
	$\tan \alpha = \frac{1.8}{5.196}$	M1		M1: any complete method, e.g.: Use of sin rule: $\sin \frac{\beta}{1.2} = \sin 60^\circ / 5.5$ ($\beta = 10.9^\circ$)
	$\alpha = 19.1^\circ$ or 19.0°	A1F	2	ft y Alternative for (c) and (d) Scale drawing: Triangle drawn as in (b) M1 North and east lines o.e. drawn in for measurements M1 Velocity components $\pm 1 \text{ mm}$ B1F B1F f.t. y Answer for $x \pm 1 \text{ mm}$ A1 Answer for $\alpha \pm 1^\circ$ A1F f.t. y
Total			10	

MAM1/W (Cont)

Q	Solution	Marks	Total	Comments
7(a)	$15 \times 0.8 \times t = 18$ $t = 1.5 \text{ sec}$	M1A1 A1F	3	M1: must attempt component, and no accel A1: 0.8 or cos 36.9 seen ft one slip e.g. 0.6 used
(b)(i)	$\sin \theta = 0.6$ or $\theta = 36.9^\circ$ or $u = 9$ $v = u + at$ $v = 15 \times 0.6 - 9.8 \times 1.5$ $= -5.7$	B1 M1A1F A1F	4	Seen, accept 37° M1: full method, must attempt component ft time, f.t. 0.6, or 'u = 9' ft one slip a.w.r.t. -5.7 Alternative to: 7 (b)(i) If vertical displacement found first: $s = 9 \times 1.5 - 4.9 \times (1.5)^2$ $s = 2.475$ $v^2 = 9^2 - 2 \times 9.8 \times 2.475$ M1 full method A1F equations correct $v = \pm 5.7$ A1F accept either Special case for part (b)(i) Re: ruling for repeated attempts; if -5.7 is seen as answer to one method, award marks and ignore other methods.
(ii)	 $\tan \theta = \frac{5.7}{12}$ $\theta = 25.4^\circ$	M1 A1F	2	Ratio of velocity components to find an angle Accept \pm
	Total		9	
	Total		60	