GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

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.

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.

Further copies of this Mark Scheme are available from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *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 for ..... method 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

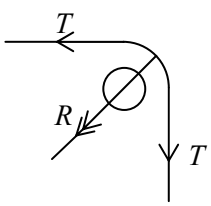
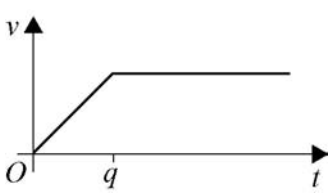
Crossed out work do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method award method and accuracy marks as appropriate

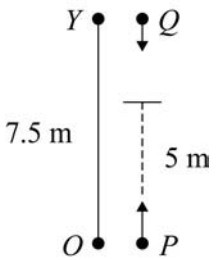
MAM1/W

Q	Solution	Marks	Total	Comments
1(a)	$v^2 = u^2 + 2as$	M1		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	3	Magnitude required
(b)(i)	Friction : $0.2 \times 2.45 = 0.49$N	M1A1	2	M1: use of $F = ma$ with $\pm$ 2.45 A1: Magnitude required
(ii)	$R = 0.2 \times g$			
	$F = \mu R$ $0.49 = \mu \times 0.2g$	M1		Use of $F = \mu R$ with $R = mg$ substituted
	$\mu = 0.25$	A1F	2	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 **v** given
(b)	sp = $\sqrt{(6^2 + 4t^2)}$ ms^{-1}	M1A1F	2	M1: sum of squares attempted giving scalar expression A1: all correct, accept $(2t)^2$ ft **v** with 2 components
(c)	$\sqrt{(6^2 + 4t^2)} = 6\sqrt{2}$	M1		o.e.; scalar expression for **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		M1: all relevant terms used
	$R = 950$ N	A1F	3	ft one slip if $R > 0$
(b)	$2100 - 1000g \times 0.1 - 950 = 1000 \times a$	M1		M1: 3 or 4 terms considered
		A1A1		– 1 each term incorrect (any error),or missing, $\alpha = 5.74^\circ$
	$a = 0.17$ ms^{-2}	A1F	4	ft one error if 4 terms considered
	Total		**7**	

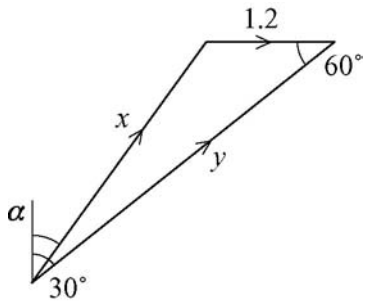
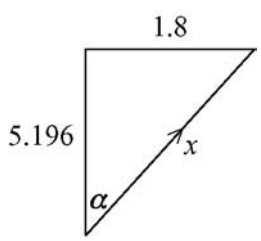
MAM1/W (Cont)

Q	Solution	Marks	Total	Comments
4(a)(i)	$T = 0.6a$	M1		Either equation (M1 A0 for use of $0.1ga$)
	$0.1g - T = 0.1a$	A1 A1		SC whole string method: $0.1g = 0.7a$ M1A1 (total mass used)
	$0.1g = 0.7a$	m1		$a =$ 1.4 A1, max 3/5)
	$a = 1.4$ ms^{-2}	A1	5	
(ii)	$T = 0.6 \times 1.4 = 0.84$ 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		recognising 2 tensions involved
	$R = 2T\cos 45^\circ$	M1		M1: attempt at Pythagoras or at a component of T
	$= 1.19$ N	A1F	3	A1: f.t. tension
(b)		B1 B1 B1	3	1st line sloping and through O 2nd line horizontal label at $t = q$
	Total		**12**	

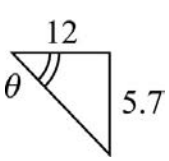
MAM1/W Cont)

Q	Solution	Marks	Total	Comments
5(a)(i)				
	Q: $s = ut + \frac{1}{2}at^2$			
	$s = 0 + \frac{1}{2} \times 9.8 \times \frac{25}{49}$	M1		M1: full method for s
	$s = 2.5$	A1	2	
(ii)	$5 + 2.5 = 7.5$ so collision occurs	A1	1	
(b)	Q: $v = 0 + 9.8 \times \frac{5}{7}$	M1		M1: full method for v
	$= 7$	A1		
	$\downarrow -0.2 \times 3.5 + 0.3 \times 7 = 0.5v$	M1A1F		M1: Momentum equation with 3 terms with appropriate masses. ft velocity of Q
	$v = 2.8\downarrow$	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		Triangle linking 3 velocities, with 1.2 easterly
		A1		Correct configuration of velocities, with x east of north and $0 < \alpha < 30^\circ$ Must see x or y or α or 30°
		A1	3	Arrows and labels of at least 2 sides
(c)	north $6\cos 30^\circ$ (= 5.20) (5.196)	B1F		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 $x^2 = 6^2 + 1.2^2 - 2\times 6\times 1.2\times\cos 60^\circ$ $x = 5.499$
	$x = 5.50$ km/h	A1	2	AWRT
(ii)	$\tan\alpha = \frac{1.8}{5.196}$	M1		M1: any complete method, e.g.: Use of sin rule: $\text{Sin}\ \frac{\beta}{1.2} = \sin 60^\circ / 5.5\ (\beta = 10.9^\circ)$
	$\alpha = 19.1^\circ$ 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 ± 1 mm B1F B1F f.t. y Answer for x ± 1 mm A1 Answer for α ± 1° A1F f.t. y
	Total		**10**	

MAM1/W (Cont)

Q	Solution	Marks	Total	Comments
7(a)	$15 \times 0.8 \times t = 18$	M1A1		M1: must attempt component, and no accel A1: 0.8 or cos 36.9 seen
	$t = 1.5$ sec	A1F	3	ft one slip e.g. 0.6 used
(b)(i)	$\sin\theta = 0.6$ or $\theta = 36.9^\circ$ or $u = 9$	B1		Seen, accept 37°
	$v = u + at$			
	$v = 15 \times 0.6 - 9.8 \times 1.5$	M1A1F		M1: full method, must attempt component ft time, f.t. 0.6, or '$u = 9$'
	$= -5.7$	A1F	4	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)	 $\tan\theta = \frac{5.7}{12}$	M1		Ratio of velocity components to find an angle
	$\theta = 25.4^\circ$	A1F	2	Accept ±
	Total		**9**	
	Total		**60**	