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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MM1A Mechanics 1A

Mark Scheme

2005 examination – June series

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.

Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	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	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	OE	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
–*x* EE	deduct *x* marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

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

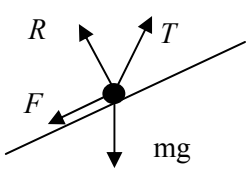
Crossed out work — do not mark unless it has not been replaced

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

MM1A/W

Q	Solution	Marks	Total	Comments
1(a)	$s_1 = \frac{1}{2} \times 15 \times 20 = 150$	M1		M1: Finding length of first stage M1: Finding length of second stage
	$s_2 = \frac{1}{2} \times 15 \times 80 = 600$	M1 A1		A1: Both distances correct
	$s = 600 + 150 = 750$ m	A1	4	A1: Correct total distance
(b)(i)	$t = \frac{750}{15} = 50$ s	B1ft	1	B1: Correct time or their distance correctly divided by 15
(ii)	Delay $= 120 - 50 = 70$ s	B1ft	1	B1: Correct time of their previous time correctly subtracted from 120 to give a positive answer
(c)	$a = \frac{15}{80} = \frac{3}{16} = 0.1875$ ms^{-2}	M1 A1		M1: Finding acceleration A1: Correct acceleration
	$F = 500000 \times 0.1875 = 93800$ N (to 3sf)	M1 A1	4	M1: Use of $F = ma$ A1: Correct force
	Total		**10**	
2(a)	$8 \times 8 + 12 \times 6 = 20v$	M1		M1: Three term equation for conservation of momentum
	$v = \frac{136}{20} = 6.8$ ms^{-1}	A1 A1	3	A1: Correct equation A1: Correct v
(b)	$8 \times 8 + 12 \times 6 = 8 \times 6.5 + 12v$	M1		M1: Four term conservation of momentum equation
	$v = \frac{84}{12} = 7$ ms^{-1}	A1 A1	3	A1: Correct equation A1: Correct v
	Total		**6**	
3(a)	$v = \sqrt{200^2 + 30^2}$	M1 A1		M1: Use of Pythagoras A1: Correct expression
	$= 202$ ms^{-1}	A1	3	A1: Correct velocity
(b)	$\tan^{-1}\left(\frac{200}{30}\right) = 081.5°$	M1 A1 A1	3	M1: Use of tan A1: Correct expression A1: Correct bearing Accept 082º or 081º
	Total		**6**	
4(a)	$9g - T = 9a$	M1		M1:Equation for one particle
	$T - 5g = 5a$	A1		A1: Correct equation
	$4g = 14a$ **AG**	M1 A1		M1:Equation for other particle A1:Correct equation
	$a = \frac{4g}{14} = 2.8$ ms^{-2}	A1	5	A1:Correct a from correct working
(b)	$T - 5g = 5 \times 2.8$	M1		M1: Substituting acceleration to find T
	$T = 63$ N	A1	2	A1: Correct tension
(c)	$s = \left(\frac{1}{2} \times 2.8 \times 0.5^2\right)$	M1		M1: Constant acceleration equation with $u = 0$ and $a \neq g$ to find s. Allow ± answers.
	$= 0.35$ m	A1		A1: Correct equation
	Total $= 2 \times 0.35 = 0.7$ m	A1 A1ft	4	A1: Correct distance A1: Doubling their distance to get total distance apart
	Total		**11**	

MM1A/W (cont)

Q	Solution	Marks	Total	Comments
5(a)	$2 = \frac{1}{2} \times 9.8t^2$ **AG**	M1A1		M1: Vertical equation with two terms including a 2 A1: Correct equation
	$t = \sqrt{\frac{4}{9.8}} = 0.639$ s	dM1 A1	4	dM1: Solving for t A1: Correct t from correct working
(b)	$s = 30\sqrt{\frac{4}{9.8}} = 19.2$ m	M1 A1	2	M1: Use of $30 \times$ time A1: Correct distance
(c)(i)	Horizontal remains constant	B1		B1: Correct description
(ii)	Vertical increases in magnitude	B1	2	B1: Correct description
	Total		**8**	
6(a)	$\mathbf{v} = 4\mathbf{j} + (3\mathbf{i} - 5\mathbf{j})t$	M1A1	2	M1: Use of $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ and $\mathbf{u} \neq 0$ or Integration A1: Correct expression
(b)	$\mathbf{v} = 3t\mathbf{i} + (4 - 5t)\mathbf{j}$ $4 - 5t = 0$	M1		M1: $\mathbf{j}$ component of velocity equal to zero
	$t = 0.8$ s	A1	2	A1: Correct t
(c)	$\mathbf{v} = 12\mathbf{i} - 16\mathbf{j}$	M1		M1: Finding velocity when $t = 4$
	$\mathbf{v} = \sqrt{12^2 + 16^2} = 20$ **AG**	A1 dM1 A1	4	A1: Correct velocity dM1: Finding the magnitude A1: Correct speed from correct working
	Total		**8**	
7(a)		B1	1	B1: Correct force diagram
(b)	$R + 20\sin 30° = 6g\cos 10°$ $R = 6g\cos 10° - 20\sin 30°$	M1A1 dM1		M1: Resolving perpendicular to the slope with 3 terms A1: Correct equation dM1: Solving for R
	$R = 47.9$ N (to 3 sf) **AG**	A1	4	A1: Correct R from correct working
(c)	$F = \mu R$	M1		M1: Use of $F = \mu R$
	$6 \times 0.4 = 20\cos 30° - 6g\sin 10° - \mu R$	M1 A1		M1: Resolving parallel to slope to get 4 term equation of motion A1: Correct equation
	$\mu R = 4.710$	A1		A1: Correct F / μR
	$\mu = \frac{4.710}{47.91} = 0.0983$	dM1 A1	6	dM1: Solving for μ A1: AWRT 0.098
	Total		**11**	
	Total		**60**	