GCE MARKING SCHEME

SUMMER 2018

MATHEMATICS – M1 (LEGACY)
0980-01

INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE MATHEMATICS – M1

SUMMER 2018 MARK SCHEME

Q	Solution	Mark	Notes
1(a)(i)	N2L on lift, upwards +ve	M1	dim correct, all forces T and $1200g$ opposing
	$T - 1200g = 1200a$		
	$T = 1200(9.8 + 0\ 2)$	A1	any correct form
	$T = 14160$ (N)	A1	cao
1(a)(ii)	$T = 1200g$ (= 11760) (N)	B1	
1(b)	$Mg - R = Ma$	M1	dim correct, all forces No extra
	$M(9.8 - 3) = 442$	A1	any correct form
	$M = 65$	A1	cao

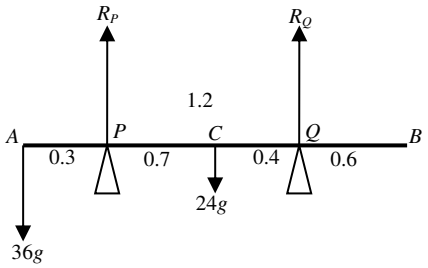
Q	Solution	Mark	Notes
2	Resolve in one direction	M1	obtain comp of resultant All forces, no extra
	$X = 16 - 9\cos 75^\circ - 21\sin 60^\circ$ $X = -4.5159$	A1	
	Resolve in perpendicular direction	M1	obtain comp of resultant All forces, no extra.
	$Y = 8 + 21\cos 60^\circ - 9\sin 75^\circ$ $Y = 9.8067$	A1	
	$\text{Resultant}^2 = 4.5159^2 + 9.8067^2$	m1	dep on both M's
	Resultant = <u>10.8 (N)</u>	A1	cao
	$\theta = \tan^{-1}\left(\frac{4.5159}{9.8067}\right)$	m1	
	$\theta = \underline{24.7^\circ}$	A1	cao

Note

−1 if answers not 1 d.p.

Q	Solution	Mark	Notes

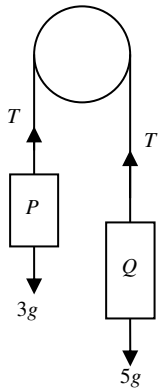
3.



Moments about P	M1	dim correct equation All forces, no extra
$36g\times0.3 + R_Q\times1.1 = 24g\times0.7$	B1 A1	any correct moment correct equation
$R_Q = 53.45$ (N)	A1	cao
Resolve vertically	M1	dim correct equation All forces, no extra
$R_Q + R_P = 36g + 24g$	A1	
$R_P = 534.55$ (N)	A1	cao

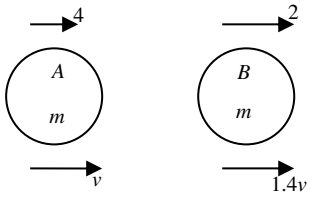
Notes

Moments about any point	M1	same conditions as above
Correct moment	B1	
Correct equation	A1	
Attempt at second equation	M1	
Correct equation	A1	
Correct answers	A1A1	

Q	Solution	Mark	Notes
4(a)			
			
	Apply N2L to Q	M1	$5g$ and T opposing, dim. correct
	$5g - T = 5a$	A1	correct equ, allow –ve a
	Apply N2L to P	M1	$4g$ and T opposing, dim. Correct
	$T - 3g = 3a$	A1	correct equ consistent with first equation
	Adding	m1	
	$8a = 2g$		
	$a = \underline{2.45\ (ms^{-2})}$	A1	cao
	$T = \underline{36.75\ N}$	A1	cao
4(b)	Light string gives rise to tension constant throughout the string.	B1	
4(c)	Smooth peg means that the tensions in the strings on both sides of the peg are equal.	B1	
<u>Notes</u> (Newton's method)			
	Attempt at Newton's method	M1	forces subtracted, masses added
	$5g - 3g = (5+3)a$	A1	
	$a = 2.45\ (ms^{-2})$	A1	cao
N2L applied to either particle		M1	wt and T opposing, dim. Correct
	$T - 3g = 3a$	A1	
	$T = 3(9.8 + 2.45)$	m1	substitution
	$T = \underline{36.75\ N}$	A1	cao

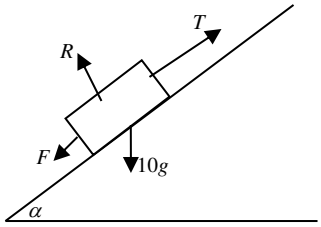
Q	Solution	Mark	Notes
5(a)	I = change in momentum $I = 0.16(20 - (-12))$ $I = 5.12$ (Ns)	M1 A1	used
5(b)	$I = Ft$ $5.12 = F \times \frac{1}{8}$ $F = 40.96$ (N)	M1 A1	used ft answer in (a)

Q	Solution	Mark	Notes
6(a)	Vel of A when B starts to fall		
	$v^2 = u^2 + 2as$, u=0, a=(±)9.8, s=(±)0.1	M1	oe complete method
	$v^2 = 0 + 2 \times 9.8 \times 0.1$	A1	
	$v = \frac{7}{5}$	A1	cao
6(b)	Vel of A when it reaches the ground		
	$v^2 = u^2 + 2as$, u=0, a=(±)9.8, s=(±)40	M1	
	$v^2 = 0 + 2 \times 9.8 \times 40$		
	$v = 28$	A1	
6(c)	Time of travel of B = time for A to reach ground		
	$v = u + at$, $u=\frac{7}{5}$, v=28, a=9.8	M1	
	$28 = \frac{7}{5} + 9.8t$	A1	ft (a) and (b)
	$t = \frac{19}{7}$	A1	
	Distance travelled by B in that time		
	$s = ut + \frac{1}{2}at^2$, u=0, a=9.8, $t=\frac{19}{7}$	M1	
	$s = 0 + \frac{1}{2} \times 9.8 \times \left(\frac{19}{7}\right)^2$	A1	ft candidates' 19/7
	$s = 36.1$	A1	cao
	Distance between A and B = 40 – 36.1 = 3.9 (m)	A1	cao

Q	Solution	Mark	Notes
7(a)			
	Conservation of momentum	M1	dim correct equ.
	$4m + 2m = mv + m \times 1.4v$	A1	
	$2.4v = 6$		
	$v = 2.5$	A1	cao
	Restitution	M1	no more than 1 sign error
	$1.4 \times 2.5 - 2.5 = -e(2 - 4)$	A1	ft v in (a)
	$e = 0.5$	A1	ft v in (a) provided $0<e<1$.
7(b)	Speed of B after collision = v'		
	$v' = 3.5 \times 0.6$	M1	ft v_A
	$v' = 2.1$ (ms^{-1})	A1	ft v_A
7(c)	Distance between A and B at time of collision with the wall = $(3.5 - 2.5)\times 5$	B1	ft v, $1.4v$
	$= 5$		
	After collision with wall, A and B approach each other with velocity = $2.1 + 2.5 = 4.6$	B1	ft v, v'
	Time to second collision between A and B		
	$= \frac{5}{4 \cdot 6}$		
	= 1.09 (s)(correct to 2 d.p.)	B1	cao

Q	Solution	Mark	Notes

8.



Resolve perpendicular to plane

$R = 10g\cos\alpha$ B1

$F = 10g\mu\cos\alpha$

With T acting upwards

N2L applied to particle M1 dim correct, all forces

$T - F - mg\sin\alpha = ma$ A1

$98 - F - 10g\sin\alpha = 0$

With T acting downwards

N2L applied to particle M1 dim correct, all forces

$F - T' - 10g\sin\alpha = ma$ A1

$F - 49 - 10g\sin\alpha = 0$

Adding

$98 - 49 = 20\times 9.8\times\sin\alpha$ m1

$\sin\alpha = \frac{1}{4}$ A1

$\cos\alpha = \frac{\sqrt{15}}{4}$

$\mu = \frac{F}{R}$ M1

$\mu = \frac{49 + 10\times 9\cdot 8\times 0\cdot 25}{10\times 9\cdot 8\times\frac{\sqrt{15}}{4}}$

$\mu = \frac{\sqrt{15}}{5} = \sqrt{\frac{3}{5}} = 0.7746$ A1 cao

Q	Solution			Mark	Notes
9(a).	$\bar{x} = 4$ (cm)			B1	
9(b)	Shape	mass	distance(y)		
	ABCE	40	2.5	B1	2.5
	ECD	36	8	B1	8
	PQR	12	7	B1	7
	ABCDE	64	$\bar{y}$	B1	areas
	Moments about *AB*			M1	dim correct equation
	$64\bar{y} + 12\times7 = 40\times2.5 + 36\times8$			A1	ft table if consistent
	$\bar{y} = 4.75$ (cm)			A1	cao