



GCE MARKING SCHEME

SUMMER 2017

MATHEMATICS - M1
0980-01

INTRODUCTION

This marking scheme was used by WJEC for the 2017 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.

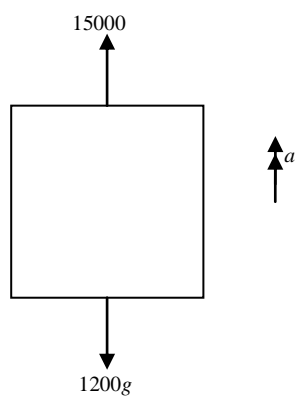
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

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

MATHEMATICS M1 (June 2017)
Markscheme

Q	Solution	Mark	Notes
---	----------	------	-------

1(a)



N2L applied to lift, upwards +ve

M1	dimensionally correct 15000, 1200g opposing No extra forces.
----	--

$$15000 - 1200g = 1200a$$

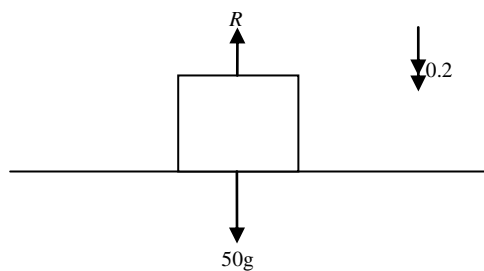
$$15000 - 1200 \times 9.8 = 1200a$$

$$a = \underline{2.7}$$

A1

A1

1(b)



N2L applied to crate, down +ve

M1	dimensionally correct R and $50g$ opposing. No extra forces.
----	--

$$50g - R = 50a$$

$$R = 50(9.8 - 0.2)$$

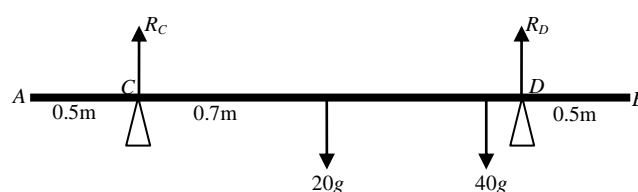
$$R = \underline{480 \text{ (N)}}$$

A1

A1

Q	Solution	Mark	Notes
2(a)	Impulse on $Q = 2(7.5 - (-3))$ $I = \underline{21 \text{ (Ns)}}$	M1 A1	magnitude required.
2(b)	Conservation of momentum $6 \times 5 + 2 \times (-3) = 6v + 2 \times 7.5$ $v = \underline{1.5 \text{ (ms}^{-1}\text{)}}$	M1 A1 A1	equation required. Allow 1 sign error cao speed required
2(c)	Restitution equation $7.5 - 1.5 = -e(-3 - 5)$ $e = \underline{0.75}$	M1 A1 A1	allow one sign error Ft v Ft v cao
2(d)	speed after rebound $= 7.5 \times 0.6$ $= \underline{4.5 \text{ (ms}^{-1}\text{)}}$	M1 A1	cao allow -4.5

Q	Solution	Mark	Notes
3.			

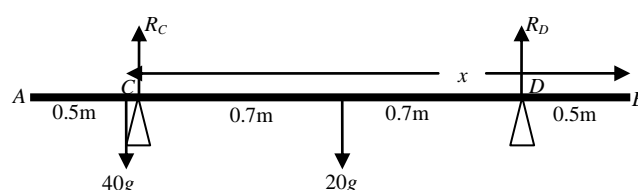


3(a)	Moments about D	M1	dimen correct equation All forces, no extra
	$40g \times 0.1 + 20g \times 0.7 = R_C \times 1.4$	B1	any correct moment
	$R_C = \underline{126(N)}$	A1	correct equation
		A1	cao
	Resolve vertically	M1	dimen correct equation All forces, no extra
	$R_C + R_D = 40g + 20g$	A1	
	$R_D = \underline{462(N)}$	A1	cao

Alternative method

Two simultaneous equations award B1 M1 A1 M1 A1 A1cao A1cao

3(b)

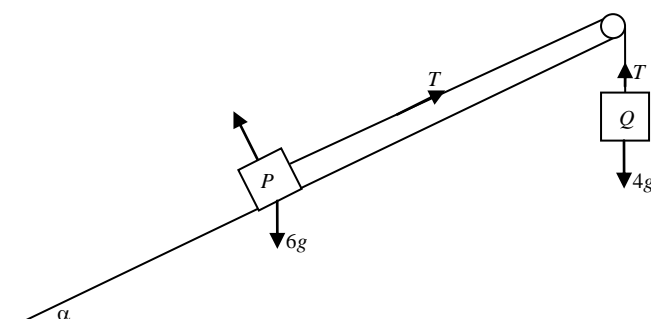


	Moments about C	M1	dimen correct equation All forces, no extra oe
	$40g(x - 1.9) + R_D \times 1.4 = 20g \times 0.7$		
	Equilibrium on point of collapse when $R_D = 0$.		
	or if moments about point not C $R_C = 60g$, (and $R_D = 0$ implied).	M1	
	$40g(x - 1.9) = 20g \times 0.7$		
	$x = \underline{2.25(m)}$	A1	cao

Q	Solution	Mark	Notes
4(a)	using $v=u+at$, $u=0$, $v=15$, $t=50$ $15 = 0 + 50a$ $a = \underline{0.3 \text{ (ms}^{-2}\text{)}}$	M1 A1 A1	 cao
4(b)	N2L $T - R = ma$ $300 - R = 800 \times 0.3$ $R = 300 - 240$ $R = \underline{60 \text{ (N)}}$	M1 A1 A1	dim correct equation Ft a cao
4(c)	using $s=ut+0.5at^2$, $u=0$, $a=0.3$ (c), $t=50$ $s = 0.5 \times 0.3 \times 50^2$ $s = 375$ Distance used in braking = $500 - 375 = 125$	M1 A1	oe FT a
	Using $v^2=u^2+2as$, $u=15$, $v=0$, $s=125$ (c) $0 = 15^2 + 2 \times a \times 125$ $a = -\frac{15^2}{2 \times 125}$ $a = -0.9$	M1 A1	oe
	$800 \times (-)(0.9) = (-)720$ N2L $-B - R = ma$ $B = \underline{660 \text{ (N)}}$	B1 M1 A1	ft a dim correct equation cao
	<u>Alternative</u> $(-)F = 800 \times (-)(0.9)$ $F = 720$ Force exerted by brakes = $720 - 60$ = $\underline{660 \text{ (N)}}$	 (B1) (M1) (A1)	 cao

Q	Solution	Mark	Notes
---	----------	------	-------

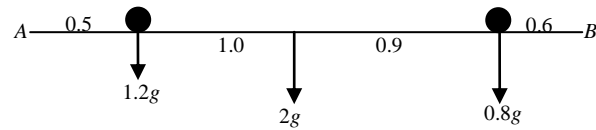
5



5(a)	$\sin \alpha = \frac{3}{5}$ $4g - T = 4a$ N2L applied to second particle $T - 6g \sin \alpha = 6a$ Adding $4g - 6g \times \frac{3}{5} = 10a$ $a = \underline{0.04g} = \underline{0.392(\text{ms}^{-2})}$ $T = \underline{3.84g} = \underline{37.632(\text{N})}$	B1 M1 A1 m1 A1 A1	Dim correct equation. T and weight opposing \sin/\cos required. cao mag req. accept 0.4 cao accept 37.6/7
5(b)	Using $v^2 = u^2 + 2as$, $u=0$, $a=0.392(\text{c})$, $s=1.5$ $v^2 = 2 \times 0.04g \times 1.5$ $v = \frac{\sqrt{3g}}{5} = \underline{1.0844(\text{ms}^{-1})}$	M1 A1 A1	oe Ft a cao
5(c)	Using $v=u+at$, $v=0$, $u=\frac{\sqrt{3g}}{5}$ (c), $a=(\pm)0.6g$ $0 = \frac{\sqrt{3g}}{5} - 0.6gt$ $t = 0.1844$ Required time = <u>0.37(s)</u>	M1 A1 A1 A1	oe Ft v from (b) cao Ft t , 2dp required.

Q	Solution	Mark	Notes
---	----------	------	-------

6.



Take moments about B

$$(1.2g + 2g + 0.8g)x = 1.2g \times 2.5 + 2g \times 1.5 + 0.8g \times 0.6$$

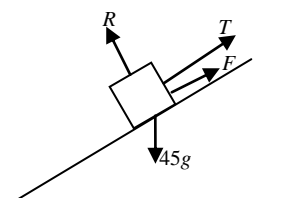
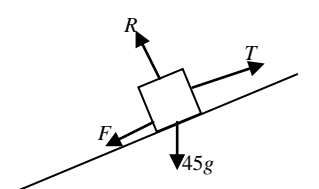
$$x = \underline{1.62 \text{ (m)}}$$

M1 dimensionally correct
4 terms equation, condone
no g throughout.

B1 any correct moment
A1 correct equation
A1

Q	Solution	Mark	Notes
---	----------	------	-------

7



Resolve perpendicular to plane
 $R = 45g \cos \alpha = (36g = 352.8)$

M1 accept $\sin \alpha$
 A1

$F = 0.5 \times R = (18g = 176.4)$

m1

N2L parallel to plane

M1 or N2L with $a=0$
 Dimensionally correct
 All forces, T and wt opp.

For greatest T
 $T = 45g \sin \alpha + F$
 $T = 27g + 18g$
 $T = \underline{45g = 441(\text{N})}$

A1 $a=0$
 A1 cao

N2L parallel to plane

M1 or N2L with $a=0$
 Dimensionally correct
 All forces, T and wt opp.
 F in opposite direction to previous N2L.

For least T
 $45g \sin \alpha = T + F$
 $T = 45g \sin \alpha - F$
 $T = 27g - 18g$
 $T = \underline{9g = 88.2(\text{N})}$

A1 $a=0$
 A1 cao

Condone absence of 'greatest/least' but if present must be correct for A1.

Q	Solution	Mark	Notes																								
8(a).	<table><tr><td></td><td>Area</td><td>from $AF(x)$</td><td>from $AB(y)$</td><td></td><td></td></tr><tr><td>$ABEF$</td><td>180</td><td>5</td><td>9</td><td>B1</td><td></td></tr><tr><td>BCD</td><td>90</td><td>15</td><td>6</td><td>B1</td><td></td></tr><tr><td>Lamina</td><td>270</td><td>x</td><td>y</td><td>B1</td><td>areas correct, allow areas in proportion 2:1:3.</td></tr></table> <p>Moments about AF</p> $270x = 180 \times 5 + 90 \times 15$ $270x = 2250$ $x = \frac{25}{3} = 8.3$ <p>Moments about AB</p> $270y = 180 \times 9 + 90 \times 6$ $270y = 2160$ $y = \underline{8}$		Area	from $AF(x)$	from $AB(y)$			$ABEF$	180	5	9	B1		BCD	90	15	6	B1		Lamina	270	x	y	B1	areas correct, allow areas in proportion 2:1:3.	M1 A1 M1 A1	cao cao
	Area	from $AF(x)$	from $AB(y)$																								
$ABEF$	180	5	9	B1																							
BCD	90	15	6	B1																							
Lamina	270	x	y	B1	areas correct, allow areas in proportion 2:1:3.																						
8(b)	Identification of correct triangle $\tan \theta = \left(\frac{10 - 25/3}{18 - 8} \right)$ $\theta = \tan^{-1} \left(\frac{5}{30} \right)$ $\theta = \underline{9.5^{(o)}} \text{ or } \theta = \underline{0.165^{(c)}}$	M1 A1 A1	Ft x, y FT x, y units not required but if present must be correct.																								