GCE MARKING SCHEME

SUMMER 2017

MATHEMATICS - M1
0980-01

INTRODUCTION

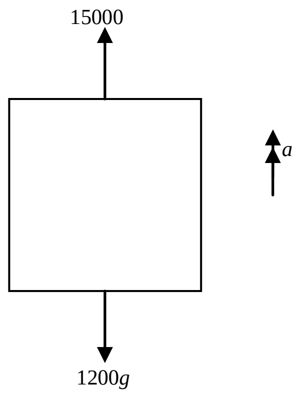
This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' 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.

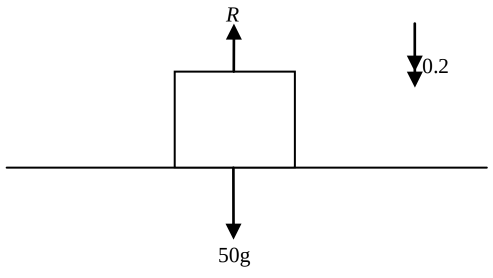
WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

MATHEMATICS M1 (June 2017)
Markscheme

Q	Solution	Mark	Notes
1(a)			



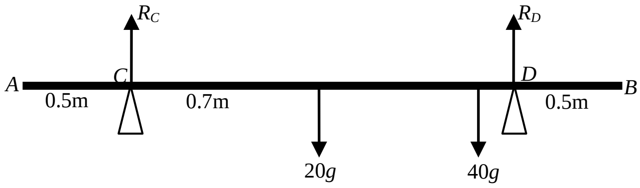
Q	Solution	Mark	Notes
	N2L applied to lift,upwards +ve	M1	dimensionally correct 15000, 1200g opposing No extra forces.
	$15000 - 1200g = 1200a$	A1	
	$15000 - 1200\times9.8 = 1200a$		
	a = <u>2.7</u>	A1	
1(b)			



Q	Solution	Mark	Notes
	N2L applied to crate, down +ve	M1	dimensionally correct R and 50g opposing. No extra forces.
	$50g - R = 50a$	A1	
	$R = 50(9.8 - 0.2)$		
	R = <u>480 (N)</u>	A1	

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

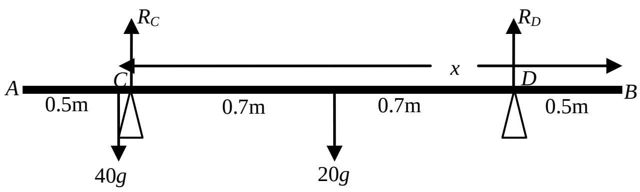
Q	Solution	Mark	Notes
3.			



Q	Solution	Mark	Notes
3(a)	Moments about D	M1	dimen correct equation
			All forces, no extra
	$40g\times0.1 + 20g\times0.7 = R_C\times1.4$	B1	any correct moment
		A1	correct equation
	$R_C = \underline{126\text{(N)}}$	A1	cao
	Resolve vertically	M1	dimen correct equation
			All forces, no extra
	$R_C + R_D = 40g + 20g$	A1	
	$R_D = \underline{462\text{(N)}}$	A1	cao

<u>Alternative method</u>
Two simultaneous equations award B1 M1 A1 M1 A1 A1cao A1cao

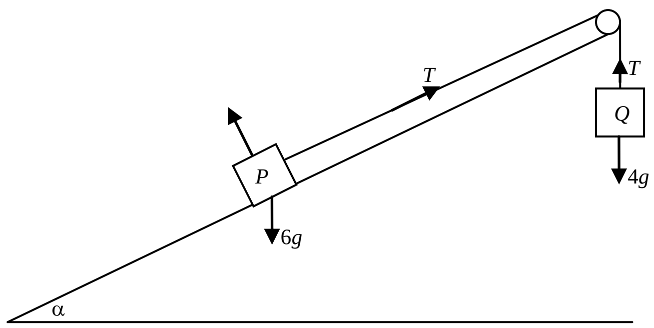
3(b)



Q	Solution	Mark	Notes
	Moments about C	M1	dimen correct equation
			All forces, no extra
			oe
	$40g(x - 1.9) + R_D\times1.4 = 20g\times0.7$		
	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	
	$40g(x - 1.9) = 20g\times0.7$		
	$x = \underline{2.25\text{(m)}}$	A1	cao

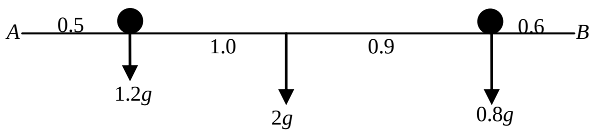
Q	Solution	Mark	Notes
4(a)	using $v=u+at$, $u=0$, $v=15$, $t=50$	M1	
	$15 = 0 + 50a$	A1	
	$a = \underline{0.3\ (\text{ms}^{-2})}$	A1	cao
4(b)	N2L $T - R = ma$	M1	dim correct equation
	$300 - R = 800 \times 0.3$	A1	Ft a
	$R = 300 - 240$		
	$R = \underline{60\ (\text{N})}$	A1	cao
4(c)	using $s=ut+0.5at^2$,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

Q	Solution	Mark	Notes
5			



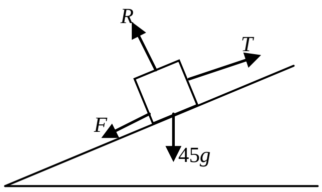
Q	Solution	Mark	Notes
5(a)	$\sin\alpha = \frac{3}{5}$		
	$4g - T = 4a$	B1	
	N2L applied to second particle	M1	Dim correct equation. T and weight opposing sin/cos required.
	$T - 6g\sin\alpha = 6a$	A1	
	Adding $4g - 6g \times \frac{3}{5} = 10a$	m1	
	$a = \underline{0.04g} = \underline{0.392(\text{ms}^{-2})}$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

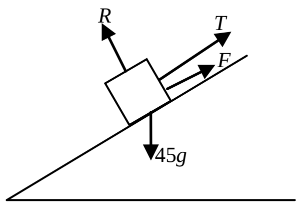
Q	Solution	Mark	Notes
6.			



Take moments about B	M1	dimensionally correct 4 terms equation, condone no g throughout.
$(1.2g + 2g + 0.8g)x$ $= 1.2g\times2.5 + 2g\times1.5 + 0.8g\times0.6$	B1	any correct moment
	A1	correct equation
$x = \underline{1.62 \text{ (m)}}$	A1	

Q	Solution	Mark	Notes
7			





	Resolve perpendicular to plane	M1	accept sinα
	$R = 45g\cos\alpha = (36g = 352.8)$	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		
	$T = 45g\sin\alpha + F$	A1	a=0
	$T = 27g + 18g$		
	$T = \underline{45g = 441(\text{N})}$	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		
	$45g\sin\alpha = T + F$	A1	a=0
	$T = 45g\sin\alpha - F$		
	$T = 27g - 18g$		
	$T = \underline{9g = 88.2(\text{N})}$	A1	cao

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

Q	Solution				Mark	Notes
8(a).		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.

	Moments about *AF*		
	$270x = 180 \times 5 + 90 \times 15$	M1	
	$270x = 2250$		
	$x = \frac{25}{3} = 8.3$	A1	cao
	Moments about *AB*		
	$270y = 180 \times 9 + 90 \times 6$	M1	
	$270y = 2160$		
	$y = \underline{8}$	A1	cao
8(b)	Identification of correct triangle	M1	
	$\tan\theta = \left(\frac{10 - 25/3}{18 - 8}\right)$	A1	Ft x, y
	$\theta = \tan^{-1}\left(\frac{5}{30}\right)$		
	$\theta = \underline{9.5^{(o)}}$ or $\theta = \underline{0.165^{(c)}}$	A1	FT x, y units not required but if present must be correct.