

More Force and Friction - Mark Scheme

Q1.

Question Number	Scheme	Marks
	$(\rightarrow) 100\cos 30 = F$ $F = 0.5 R \text{ seen}$ $(\downarrow) mg + 100\cos 60 = R$ $m = 13 \text{ kg or } 12.6 \text{ kg}$	M1 A1 A1 (B1) M1 A1 DM1 A1 [7]

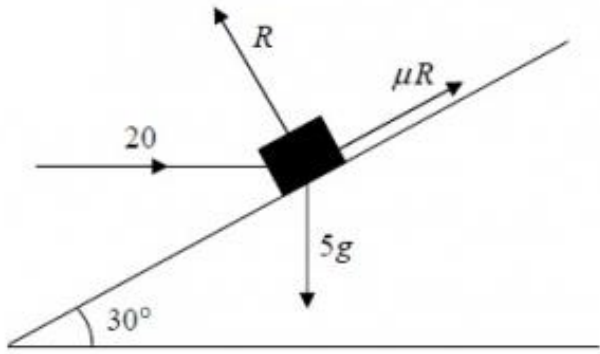
Q2.

Question Number	Scheme	Marks
	$F = \mu R$ $(\nwarrow), R = 10\sin \alpha + 5g\cos \alpha \text{ (45.2)}$ $(\nearrow), F = 5g\sin \alpha - 10\cos \alpha \text{ (21.4)}$ $\mu = \frac{g\sin \alpha - 2\cos \alpha}{2\sin \alpha + g\cos \alpha} = 0.47 \text{ or } 0.473$	B1 M1 A2 M1 A2 M1 A1 9
	Notes	
	B1 for $F = \mu R$ seen or implied First M1 for resolving perpendicular to the plane with usual rules First and second A1's for a correct equation. A1A0 if one error. Second M1 for resolving parallel to the plane with usual rules Third and fourth A1's for a correct equation. A1A0 if one error. If m is used instead of 5, penalise once in each equation. Third M1 <u>independent</u> for eliminating R to produce an equation in μ only. Does not need to be $\mu = \dots$ Fifth A1 for 0.47 or 0.473.	

Q3.

Question Number	Scheme	Marks
	$T \cos \alpha - F = 2g \cos 60^\circ$	M1 A1
	$T \sin \alpha + R = 2g \cos 30^\circ$	M1 A1
	$F = \frac{1}{3} R$	B1
	eliminating F and R	DM1
	$T = g(1 + \frac{1}{\sqrt{3}})$, 1.6g (or better), 15.5, 15 (N)	DM1 A1
		(8)
		[8]
Notes for Question		
Q	First M1 for resolving parallel to the plane with correct no. of terms and both T and $2g$ terms resolved. First A1 for a correct equation. (use of α instead of 30° or 60° or vice versa is an A error not M error; similarly if they use $\sin(3/5)$ or $\cos(4/5)$ when resolving, this can score M1A0) Second M1 for resolving perpendicular to the plane with correct no. of terms and both T and $2g$ terms resolved. Second A1 for a correct equation (use of α instead of 30° or 60° or vice versa is an A error not M error; similarly if they use $\sin(3/5)$ or $\cos(4/5)$ when resolving, this can score M1A0) B1 for $F = 1/3 R$ seen or implied. Third M1, dependent on first two M marks and appropriate angles used when resolving in <i>both</i> equations, for eliminating F and R. Fourth M1 dependent on third M1, for solving for T Third A1 for 15(N) or 15.5 (N). N.B. The first two M marks can be for two resolutions in any directions. Use of $\tan \alpha = 4/3$ leads to an answer of 17.83...and can score max 7/8.	

Q4.

Question Number	Scheme	Marks
	 (a) $\perp$ plane $R = 20 \cos 60^\circ + 5g \cos 30^\circ$ $= 52.4 \text{ (N)}$ or 52 (b) P plane $F_r = \mu R$ $F + 20 \cos 30^\circ = 5g \cos 60^\circ$ Leading to $\mu = 0.137$ or 0.14	M1 A2(1,0) A1 (4) B1 M1 A2(1, 0) A1 (5) [9]

(a)

First M1 for resolving perpendicular to plane with usual criteria

First A2 for a correct equation (A1A0 one error, A0A0 for two or more errors)

Second A1 for either 52 or 52.4

N.B. In part (a), the M1 is for a complete method, so they must have sufficient equations to be able to solve for R . The A2 marks are then for *all* the equations.

(b)

B1 for use of $F = \mu R$ (could just be on diagram)

First M1 (allow if F is used rather than μR) for resolving parallel to the plane with usual criteria

First A2 for a correct equation (A1A0 one error, A0A0 for two or more errors)

Second A1 for either 0.14 or 0.137

N.B. If they resolve vertically AND horizontally, there are max 6 marks available (M1A2, M1A2) for the TWO equations, but if they only have one equation, there are no marks available for that equation.

The marks for the horizontal resolution should be entered first on ePen.

Q5.

Question Number	Scheme	Marks
<u>OR</u>	$\begin{aligned} &\nearrow 4 \cos \alpha + F = W \sin \alpha \\ &\nwarrow R = 4 \sin \alpha + W \cos \alpha \\ &F = 0.5R \\ &\cos \alpha = 0.8 \quad \text{or} \quad \sin \alpha = 0.6 \\ &R = 20\text{N} \quad ** \quad \text{GIVEN ANSWER} \\ &W = 22\text{N} \end{aligned}$	M1 A1 M1 A1 B1 B1 M1 A1 A1
	$\begin{aligned} &\rightarrow R \sin \alpha = 4 + F \cos \alpha \\ &\uparrow R \cos \alpha + F \sin \alpha = W \\ &F = 0.5R \\ &\cos \alpha = 0.8 \quad \text{or} \quad \sin \alpha = 0.6 \\ &R = 20\text{N} \quad ** \quad \text{GIVEN ANSWER} \\ &W = 22\text{N} \end{aligned}$	M1 A1 M1 A1 B1 B1 M1 A1 A1

(9)

(9)

9