

Question	Scheme	Marks	AOs
2(a)(i)	Resolve vertically	M1	3.1b
	$F$ acting UP the plane: <b>OR</b> $F$ acting DOWN the plane: $(\uparrow) F \sin \alpha + 68.6 \cos \alpha = 5g$ $\qquad\qquad\qquad -F \sin \alpha + 68.6 \cos \alpha = 5g$	A1	1.1b
	Other possible equations from which $X$ would need to be eliminated to give an equation in $F$ <b>only</b> to earn the M mark are shown below.  The equation in $F$ <b>only</b> must then be correct to earn the A mark.  Possible equations: $(\nwarrow) 68.6 = X \sin \alpha + 5g \cos \alpha$ (leads to $X = 49$ with $g = 9.8$ ) $F$ acting UP the plane: <b>OR</b> $F$ acting DOWN the plane: $(\nearrow) F + X \cos \alpha = 5g \sin \alpha$ $\qquad\qquad\qquad -F + X \cos \alpha = 5g \sin \alpha$ $(\rightarrow) F \cos \alpha + X = 68.6 \sin \alpha$ $\qquad\qquad\qquad -F \cos \alpha + X = 68.6 \sin \alpha$		
	9.8 (N) (49/5 is A0) <b>N.B.</b> If sin and cos are interchanged in all equations, this leads to an answer of 9.8 in the wrong direction and can only score (a) (i)M1A0A0 (ii) A0	A1	1.1b
		(3)	
2(a)(ii)	Down the plane (Allow down or downwards or an arrow $\swarrow$ , but must appear as the answer to (a) (ii) not just on the diagram.)	A1	2.2a
		(1)	
2(b)	<b>N.B.</b> If they use $R = 68.6$ in this part, the maximum they can score is M1A1M0A0M0A0  If they use $F = 9.8$ or their $F$ from (a) in this part, the maximum they can score is M1A1M0A0M0A0		
	Equation of motion down the plane	M1	2.1
	$5g \sin \alpha - F = 5a$ $\qquad\qquad\qquad$ Allow $(-a)$ instead of $a$	A1	1.1b
	Resolve perpendicular to the plane	M1	3.1b
	$R = 5g \cos \alpha$	A1	1.1b
	$F = 0.5R$ seen	M1	3.4
	$a = 1.96$ or $2.0$ or $2 \text{ (m s}^{-2}\text{)}$ or $\frac{1}{5}g$	A1	1.1b
		(6)	
(10 marks)			

Notes:		
2a (i)	M1	Complete method to obtain an equation in $F$ <b>only</b> . For <b>each</b> equation used, correct no. of terms, dimensionally correct, condone sin/cos confusion and sign errors, each term that needs to be resolved must be resolved.
	A1	Correct equation in $F$ only, trig does <b>not</b> need to be substituted
	A1	cao (must be <b>positive</b> )
2a (ii)	A1	cao. Note that this mark is <b>dependent</b> on an answer of 9.8 or -9.8 for (a)(i) <u>from a fully correct solution</u> unless they have used $g = 9.81$ , in which case the answer will be 9.7 or - 9.7 (2sf) see <b>SC2</b> below. <b>N.B.</b> Allow this mark, if their answer to (a)(i) is fully correct apart from a small error due to use of inaccurate trig i.e using an angle $36.9^\circ$
		<b>SC 1:</b> If they use $\mu R$ at any point (with an unknown $\mu$ ) for $F$ in part (a), can score (a)(i) max M1A1A0 (a) (ii) A1, where they must have obtained $\mu R = 9.8$ or $- 9.8$ , <b>from correct working</b> .  <b>SC 2:</b> <b>If <math>g = 9.81</math> is used consistently throughout 2(a)</b> , (leading to $X = 48.9\dots$ and $F = 9.7$ (2sf)) can score max (a)(i) M1A1A0 (a)(ii) A1
2b	M1	Correct no.of terms, dimensionally correct, condone sin/cos confusion and sign errors, each term that needs to be resolved must be resolved.
	A1	Correct equation <b>for their <math>F</math></b> .
	M1	Correct no. of terms, dimensionally correct, condone sin/cos confusion and sign errors, each term that needs to be resolved must be resolved. ( <b>N.B.</b> M0 if $R = 68.6$ (N) is used in this equation)
	A1	Correct equation
	M1	Could be seen on a diagram ( <b>N.B.</b> M0 if $R = 68.6$ (N) is used)
	A1	Cao. <b>Must be positive</b> .