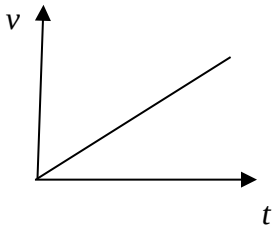
Question	Scheme	Marks	AOs
	Mark parts (a) and (b) together		
1(a)	Equation of motion for A	M1	3.3
	$3mg\sin\alpha - F - T = 3ma$	A1	1.1b
		(2)	
1(b)	Resolve perpendicular to the plane	M1	3.4
	$R = 3mg\cos\alpha$	A1	1.1b
	$F = \frac{1}{6}R$	B1	1.2
	Equation of motion for B **OR** for whole system	M1	3.3
	$T - mg = ma$ **OR** $3mg\sin\alpha - F - mg = 3ma + ma$	A1	1.1b
	Complete method to solve for a	DM1	3.1b
	$a = \frac{1}{10}g$ *	A1*	2.2a
		(7)	
1(c)		B1	1.1b
	e.g. acceleration (of B) is constant; dependent on first B1	DB1	2.4
		(2)	
1(d)	e.g. the tensions in the two equations of motion would be different. Tension on A would be different to tension on B	B1	3.5a
		(1)	
			(12 marks)

Notes: **N.B.** If m's are consistently missing treat as a MR, so max
(a) M1A0 (b) M1A0B0M1A1M1A1 (c) B1B1 (d) B1

For (a) and (b), allow verification, but must see full equations of motion.

1a	M1	Equation in T and a with correct no. of terms, condone sign errors and sin/cos confusion (If one of the 3's is missing, allow M1) N.B. Treat sin(3/5) etc as an A error but allow recovery
	A1	Correct equation (allow $(-a)$ instead of a in <u>both</u> equations)

1b	M1	Correct no. of terms, condone sign errors and sin/cos confusion Allow if appears in (a)
	A1	Correct equation
	B1	Seen anywhere in (a) or (b), including on a diagram
	M1	Equation (for B) in T and a with correct no. of terms, condone sign errors and sin/cos confusion **OR Whole system equation** with correct no. of terms, condone sign errors and sin/cos confusion
	A1	Correct equation
	DM1	Complete method (trig may not be substituted), dependent on M1 in (a) and second M1 in (b) if they use two equations, or second M1 in (b) if they use one equation.
	A1*	Correct answer correctly obtained.
1c	B1	Straight line starting at the origin (could be reflected in the t-axis). B0 if continuous vertical line at the end.
	DB1	Dependent on first B1, for any equivalent statement
1d	B1	B0 if incorrect extras

Question	Scheme	Marks	AOs
2(a)(i)	Resolve vertically	M1	3.1b
	F acting UP the plane: **OR** *F* acting DOWN the plane: $(\uparrow) F\sin\alpha + 68.6\cos\alpha = 5g$ $-F\sin\alpha + 68.6\cos\alpha = 5g$ Other possible equations from which *X* would need to be eliminated to give an equation in *F* **only** to earn the M mark are shown below. The equation in *F* **only** 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: **OR** *F* acting DOWN the plane: $(\nearrow) F + X\cos\alpha = 5g\sin\alpha$ $-F + X\cos\alpha = 5g\sin\alpha$ $(\rightarrow) F\cos\alpha + X = 68.6\sin\alpha$ $-F\cos\alpha + X = 68.6\sin\alpha$	A1	1.1b
	9.8 (N) (49/5 is A0) **N.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 ↙, but must appear as the answer to (a) (ii) not just on the diagram.)	A1	2.2a
		(1)	
2(b)	**N.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
	$5g\sin\alpha - F = 5a$ 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 (m s^{-2}) or $\frac{1}{5}g$	A1	1.1b
		(6)	
			(10 marks)

Notes:		
2a (i)	M1	Complete method to obtain an equation in F **only.** For **each** 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 **not** need to be substituted
	A1	cao (must be **positive**)
2a (ii)	A1	cao. Note that this mark is **dependen**t on an answer of 9.8 or -9.8 for (a)(i) from a fully correct solution unless they have used $g = 9.81$, in which case the answer will be 9.7 or – 9.7 (2sf) see **SC2** below. **N.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^o
		SC 1: If they use μR at any point (with an unknown μ) 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, **from correct working**. **SC 2:** **If $g = 9.81$ is used consistently throughout 2(a)**, (leading to $X = 48.9\ldots$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 **for their *F***.
	M1	Correct no. of terms, dimensionally correct, condone sin/cos confusion and sign errors, each term that needs to be resolved must be resolved. (**N.B.** M0 if $R = 68.6$ (N) is used in this equation)
	A1	Correct equation
	M1	Could be seen on a diagram (**N.B**. M0 if $R = 68.6$ (N) is used)
	A1	Cao. **Must be positive**.