

Mechanics 1 Resolving Forces Answers

8(a)(i)	$R = 80 \cos 25^\circ$	M1	3	component attempted correct component cao
	$R = 72.5\text{N}$	A1		
(ii)	$F = 0.32 \times 72.5$	M1	2	condone inequality cao
	$F = 23.2\text{N}$	A1		
(iii)	$T + F = 80 \cos 65^\circ$	M2		3 forces direction correct, component attempted component
		A1		
(iv)	$T = 10.6\text{N}$	A1✓	4	✓ friction
	$T = F + 80 \cos 65^\circ$	M1		3 forces, direction correct, component attempted component
		A1		
	$T = 57.0\text{N}$ (57N)	A1✓	3	✓ friction
(iv)	$\text{Mass} = \frac{80}{g} = (8.16\text{kg})$	B1	1	
(b)	$80 \cos 65^\circ - F = \text{mass} \times \text{acceleration}$	M1		3 terms, component attempted

$$10.6 = \frac{80}{g} \times \text{acc}$$

$$\text{acc} = 1.30 \text{ m s}^{-2}$$

$$(1.3 \text{ m s}^{-2})$$

A1

A1

3

all correct

cao

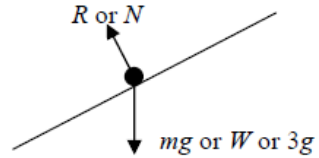
Total**16**

2(a)	$P = 5 + 8 \cos 60^\circ$	M1	3	Both relevant forces, component of 8N attempted All correct CAO
	$P = 9$	A1		
(b)	$Q = 8 \cos 30^\circ$	M1	2	Component of 8N attempted AWRT 6.93
	$Q = 6.93$ or $4\sqrt{3}$	A1		
Total			5	

4(a)		B1	1	Accept W or mg (or 6.86) for weight Arrows and labels needed (can replace W with 2 correct components)
(b)	$R = 0.7g \cos 22^\circ$ $R = 6.36 \text{ N}$	M1 A1 A1	3	component of weight attempted all correct, including signs CAO
(c)	$F = 0.25 \times 6.36$ $F = 1.59 \text{ N}$	M1 A1	2	CAO
(d)	$5.6 - 0.7g \sin 22^\circ - 1.59 = 0.7a$ $a = 2.06 \text{ ms}^{-2}$	M1 A2 A1F	4	4 terms with weight component attempted A marks -1 each error, accept $\pm 0.7a$ FT one error, accept \pm
Total			10	

3(a)	$F = \sqrt{6^2 + 5^2}$ $= \sqrt{61} = 7.81$ Alt $\alpha = \tan^{-1}\left(\frac{5}{6}\right) = 39.8^\circ$ $F = \frac{6}{\cos 39.8} = 7.81$ or $F = \frac{5}{\sin 39.8} = 7.81$	M1A1 A1 (M1A1) (A1)	3	Obtaining an equation for F with square or root. Correct equation Correct force Equation for F with a value for α . Correct equation Correct force
(b)	$\alpha = \tan^{-1}\left(\frac{5}{6}\right)$ or $\cos^{-1}\left(\frac{6}{7.81}\right)$ or $\sin^{-1}\left(\frac{6}{7.81}\right)$ $= 39.8^\circ$ Alt $\frac{\sin \alpha}{5} = \frac{\sin 90^\circ}{\sqrt{61}}$ $\alpha = 39.8^\circ$	M1 A1 A1	3	Obtaining an equation for α using trigonometry. Correct equation (using their F) Correct angle Accept values between 39.7 and 39.9
Total			6	

6(a)		B1	1	Correct diagram with arrows and labels Must not use F instead of P Condone resistance instead of P
(b)	$P = 100 \times 9.8 \sin 4^\circ$ $= 68.4$	M1 M1 A1	3	Resolving weight (must see 100) Using $\sin 4^\circ$ or $\cos 86^\circ$ AG Correct P from correct working
(c)	$100a = 100 \times 9.8 \sin 5^\circ - 100 \times 9.8 \sin 4^\circ$ $a = \frac{100 \times 9.8 \sin 5^\circ - 100 \times 9.8 \sin 4^\circ}{100}$ $= 0.171$	M1 A1 A1	4	Three term equation of motion Weight resolved correctly Correct equation
(d)	You would expect P to vary with the speed of the car.	B1	1	Correct explanation
			9	
3(a)	$T_1 \sin 35^\circ = T_2 \sin 35^\circ$ $T_1 = T_2$ OR $T_1 \cos 55^\circ = T_2 \cos 55^\circ$ $T_1 = T_2$	M1 A1	2	Resolving two forces and forming an equation, with different tensions for each string Correct result from correct working
(b)	$T_1 \cos 35^\circ + T_2 \cos 35^\circ = 2 \times 9.8$ $T_1 \cos 35^\circ + T_1 \cos 35^\circ = 2 \times 9.8$ $T_1 = \frac{2 \times 9.8}{2 \cos 35^\circ} = 12.0 \text{ N (to 3sf)}$	M1 A1 A1 dM1 A1	5	Resolving forces to form a three term vertical equation Correct equation T_1 or T_2 eliminated correctly Solving for T_1 or T_2 Correct tension Accept 12 N or 11.9 N
(c)	$2 \times 40 \cos 35^\circ = 9.8m$ $m = \frac{80 \cos 35^\circ}{9.8} = 6.69 \text{ kg}$ OR $m = \frac{40}{11.96} \times 2$ $= 6.69 \text{ kg}$	M1 A1 A1	3	Forming an equation with two tensions to find m Correct equation Correct mass Accept 6.68
	Total		10	

6(a)(i)		B1	1	Correct diagram with arrows and labels
(ii)	$3a = 3g \sin 30^\circ$ $a = g \sin 30^\circ = 4.9 \text{ ms}^{-2}$	M1 A1	2	Two term equation of motion AG Correct acceleration from correct working (Allow $a = g \sin 30^\circ$)
(b)(i)	$5 = \frac{1}{2} a \times 2^2$ $a = 2.5 \text{ ms}^{-2}$	M1 A1	2	Constant acceleration equation with $u = 0$ AG Correct answer from correct working. (Use of $v = 5$ must be justified)
(ii)	$3 \times 2.5 = 3g \sin 30^\circ - F$ $F = 3g \sin 30^\circ - 7.5$ $= 7.20 \text{ N (to 3 sf)}$	M1 A1 A1	3	Three term equation of motion Correct equation Correct F Accept 7.2 N
(iii)	$R = 3g \cos 30^\circ (= 25.46)$ $7.2 = \mu \times 3g \cos 30^\circ$ $\mu = \frac{7.2}{3g \cos 30^\circ} = 0.283$	M1 A1 M1 A1F A1F	5	Resolving perpendicular to the slope to find R Correct R Use of $F = \mu R$ Correct expression Correct μ Accept 0.282 (Follow through from incorrect F from above, but not an incorrect R)
(iv)	Reduce a , as the air resistance would reduce the magnitude of the resultant force or because the air resistance increases as the velocity increases towards its terminal value	B1 B1	2	Reduces Explanation Second B1 dependent on the first B1 mark
Total			15	