Oxford Revise | Edexcel A Level Maths | Answers

- Method (**M**) marks are awarded for showing you know a method and have attempted to apply it.
- Accuracy (**A**) marks should only be awarded if the relevant M marks have been awarded.
- Unconditional accuracy (**B**) marks are awarded independently of M marks. They do not rely on method.
- The abbreviation **o.e.** means 'or equivalent (and appropriate)'.

Please note that:

- efficient use of advanced calculators is expected
- inexact numerical answers should be given to three significant figures unless the question states otherwise; values from statistical tables should be quoted in full
- when a value of g is required, it is taken as $g = 9.8\ \text{m s}^{-2}$ unless stated otherwise in the question.

Chapter 37 Dynamics

Question	Answer	Extra information	Marks
	$v^2 = u^2 + 2as$ $0 = 15^2 + 2a(75)$ $(a = -1.5)$	Attempting to use $v^2 = u^2 + 2as$ to find acceleration Correct equation	M1 A1
37.1	$-F = 0.2 \times(-1.5)$	Applying $F = ma$ in direction of motion	M1
	$R = 0.2g$ $\mu = \dfrac{0.3}{0.2\times 9.8} = 0.153$	Resolving vertically Use of $F = \mu R$ to obtain correct answer	M1A1 A1

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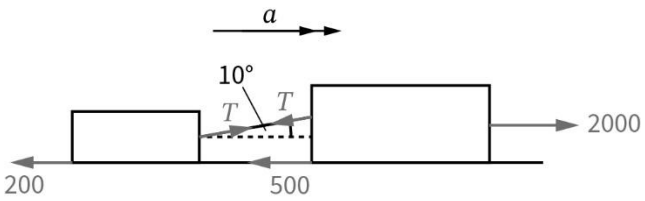
Question	Answer	Extra information	Marks
	Total		**6 marks**
37.2 (a) and (b)	 $F = ma$ in the direction of motion Car: $2000 - T\cos 10° - 500 = 1000a$ (1) Trailer: $T\cos 10° - 200 = 600a$ (2) $a = 0.81$ (m s^{-2}) $T = 698$ (N)	Parts (a) and (b) marked together Equation for car Equation for trailer Correct a Correct T	 M1A1 M1A1 A1 A1
	Total		**6 marks**

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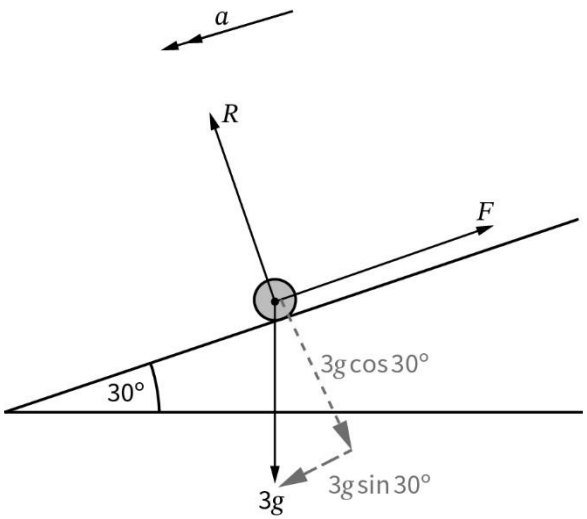
Question	Answer	Extra information	Marks
37.3			
	$15 = \frac{1}{2}a(100)$	Use of $s = ut + \frac{1}{2}at^2$ to find a	M1
	$a = 0.3$ (m s^{-2})	Correct a	A1
	$R = 3g \cos 30 = 25.46$ (N)	Resolving perpendicular to the plane	M1A1
	$3g \sin 30 - F = 3a$ $(F = 13.8)$	Applying $F_{res} = ma$ parallel to the plane	M1A1
	$\mu = \frac{13.8}{25.46}$ $= 0.54$ (to 2 s.f)	Use of $F = \mu R$ to obtain correct answer	A1
	Total		**7 marks**

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Question	Answer	Extra information	Marks
37.4	$\begin{pmatrix}3\\2\end{pmatrix}+\begin{pmatrix}-5\\b\end{pmatrix}+\begin{pmatrix}a\\-4\end{pmatrix}=2\begin{pmatrix}2\\-3\end{pmatrix}$	Applying $F_{res} = ma$	M1A1
	i components $3 - 5 + a = 4$ **j** components $2 + b - 4 = -6$	Splitting into two equations	M1
	$a = 6$, $b = -4$	Both correct	A1
	Total		**4 marks**
37.5 (a)	$3g - T = 3a$	Applying $F_{res} = ma$ for vertical direction	M1A1
	$T - 1.8g = 1.8a$	Applying $F_{res} = ma$ for horizontal direction	M1A1
	$a = \left(\frac{g}{4}\right) = 2.45$ (m s^{-2})	Correct answer only	A1
37.5 (b)	The acceleration of each particle is the same	Valid explanation	B1

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Question	Answer	Extra information	Marks
37.5 (c)	$v^2 = 2\left(\frac{g}{4}\right)\times 0.5$	Use of $v^2 = u^2 + 2as$ to find the velocity of each particle when the string breaks	M1A1
	$v^2 = \left(\frac{g}{4}\right)$		
	$(v = 1.5652\ldots)$		
	$1.5652 = \left(\frac{g}{4}\right)t$	Finding time for this part of the motion using $v = u + at$	M1
	$(t = 0.6388\ldots)$		
	$1.5 = 1.5652\,t + 4.9t^2$	Use of $s = ut + \frac{1}{2}at^2$	M1A1
	$4.9t^2 + 1.5652t - 1.5 = 0$		
	$t = 0.4161\ldots$ (s)		
	Total time to reach floor = $0.4161\ldots + 0.6388\ldots$		
	$= 1.05$ (s)	Correct total time	A1
	Total		**12 marks**

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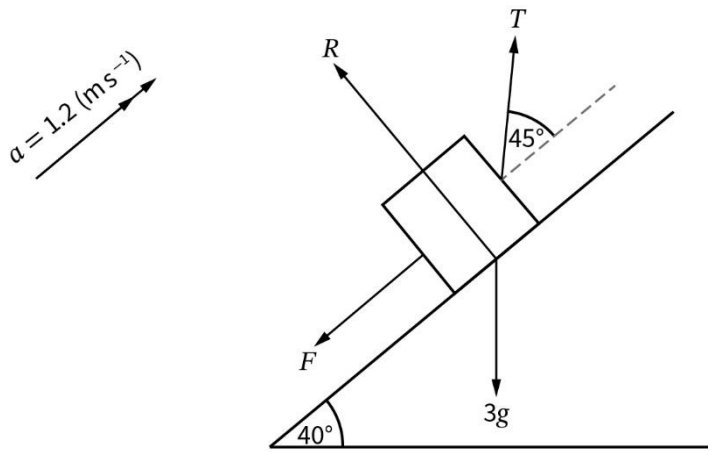
Question	Answer	Extra information	Marks
37.6 (a)	 $T\cos 45° - F - 3g\sin 40° = 3(1.2)$ (1) $R + T\sin 45° = 3g\cos 40°$ (2) $F = 0.35(3g\cos 40° - T\sin 45°)$ (3) $T\cos 45° - 0.35(3g\cos 40° - T\sin 45°) - 3g\sin 40° = 3.6$ $T = 31.8$ (N)	Applying $F_{res} = ma$ parallel to the slope Resolving perpendicular to the plane Use of $F = \mu R$ and equation (2) Substituting (3) into (1) and solving for T Correct T	M1A1 M1A1 M1 M1 A1
37.6 (b)	When the rope breaks, $T = 0$ $R = 3g\cos 40°$ $F = 0.35(3g\cos 40°)$ $= 7.8825\ldots$ $3g\sin 40° - 7.8825\ldots = 3a$ $a = 3.67$ (m s^{-2})	Resolving perpendicular to the plane Use of $F = \mu R$ Applying $F_{res} = ma$ parallel to the slope Correct a	M1 M1 M1 A1
	Total		**11 marks**

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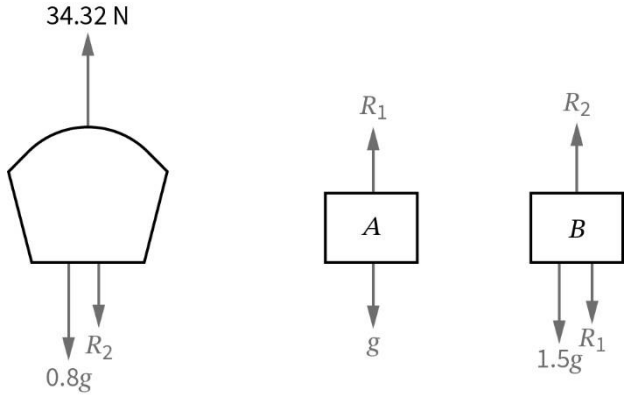
Question	Answer	Extra information	Marks
37.7 (a)	$T - g - 1.5g - 0.8g = 3.3 \times 0.6$ $T = 34.3$ (N)	Applying $F_{res} = ma$ upwards on whole system Correct answer	M1A1 A1
37.7 (b)	 $R_1 - g = 1 \times 0.6$ $R_1 = 10.4$ The force exerted by brick B on brick A is 10.4 N	 Applying $F_{res} = ma$ upwards to A Correct answer only	 M1A1 A1
37.7 (c)	$34.32 - 0.8g - R_2 = 0.8 \times 0.6$ $R_2 = 26$ The force exerted by brick B on the bucket is 26 (N)	Applying $F_{res} = ma$ upwards to the bucket Correct answer	M1A1 A1
	Total		**9 marks**

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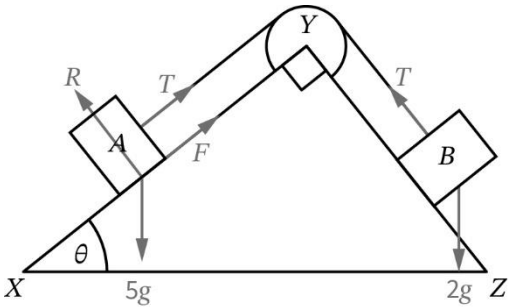
Question	Answer	Extra information	Marks
37.8 (a)	 $\tan\theta = \frac{3}{4}, \cos\theta = \frac{4}{5}, \sin\theta = \frac{3}{5}$ Let angle XZY be α: $\cos\alpha = \frac{3}{5}, \sin\alpha = \frac{4}{5}$ <u>Particle A</u> $R = 5g\cos\theta = 4g$ $F = 4\mu g$ $5g\sin\theta - T - F = 5a$ $3g - T - 4\mu g = 5a$ (1) <u>Particle B</u> $T - 2g\sin\alpha = 2a$ $T - \frac{8g}{5} = 2a$ (2) $\frac{7g}{5} - 4\mu g = 7a$	Resolving perpendicular to the plane down the plane Use of $F = \mu R$ Use of $F_{res} = ma$ parallel to the plane Use of $F_{res} = ma$ parallel to the plane up the plane Use of equations (1) and (2) to eliminate T	M1A1 B1 M1A1 M1A1 M1

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Question	Answer	Extra information	Marks
	$7g - 20\mu g = 35a$ $a = \frac{(7-20\mu)g}{35}$	Correct answer	A1
37.8 (b)	As A accelerates down the plane, acceleration from (a) must be positive. $\frac{(7-20\mu)g}{35} > 0$ $\mu < \frac{7}{20}$	Correct inequality, setting $a > 0$ Correct range	M1 A1
	Total		**11 marks**
37.9	$18 = 3 + 30a$ $15 = 30a$ $(a = 0.5)$ $s = 3(30) + \frac{1}{2}(0.5)(30)^2$ $(s = 315)$ Distance from A to C is 157.5 (m) $157.5 = 3t + \frac{1}{2}(0.5)t^2$ $t = 19.8$ (s)	Use of $v = u + at$ from A to B to find acceleration Use of $s = ut + \frac{1}{2}at^2$ from A to B to find distance AB Use of $s = ut + \frac{1}{2}at^2$ from A to C to find time Correct answer only. Must exclude negative t value for mark.	M1A1 M1A1 M1A1 A1
	Total		**7 marks**

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Question	Answer	Extra information	Marks
37.10 (a)	$R = 4g\cos\theta$	Resolving perpendicular to the plane	M1A1
	$\cos\theta = \frac{12}{13}$		
	$R = \frac{48}{13}g$		
	$F = 4g\sin\theta$	Resolving parallel to the plane	M1A1
	$\sin\theta = \frac{5}{13}$		
	$F = \frac{20}{13}g$		
	$\mu = \frac{F}{R} = \frac{20g}{13} \div \frac{48g}{13}$	Use of $F = \mu R$ as in limiting equilibrium	M1
	$= \frac{20}{48}$		
	$= \frac{5}{12}$		
	$= 0.417$	Correct answer	A1

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Question	Answer	Extra information	Marks
37.10 (b)	Let horizontal force be P		
	$R = 4g\cos\alpha + P\sin\alpha$	Resolving perpendicular to the plane	M1A1
	$R = \frac{20}{13}g + \frac{12}{13}P$		
	$P\cos\alpha + F = 4g\sin\alpha$	Resolving parallel to the plane	M1A1
	$F = \frac{48}{13}g - \frac{5}{13}P$		
	$\frac{48}{13}g - \frac{5}{13}P = \frac{5}{12}\left(\frac{20}{13}g + \frac{12}{13}P\right)$	Use of $F = \mu R$ to form equation in P only	M1
	$P\left(\frac{5}{13} + \frac{5}{13}\right) = \frac{48}{13}g - \frac{25}{39}g$		
	$P = 38.9$ (N)	Correct answer only	A1
	Total		**12 marks**

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