EDEXCEL - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **MECHANICS 6677** Paper No. **M1**

Question number	Scheme	Marks
1.	3 → 0.5 ● ← 2 ● 0.2 Before → 1.5 ● → v After (Momᵐ eqn. with 4 terms) (a) $0.5 \times 3 - 0.2 \times 2 = 0.5 \times 1.5 + 0.2 \times v$ $\Rightarrow v = 1.75 \text{ ms}^{-1}$	M1 A1 A1 (3)
	(b) $I = 0.2(2 + 1.75)$ $= 0.75 \text{ Ns}$	M1 A1✓ A1 (3) (6)

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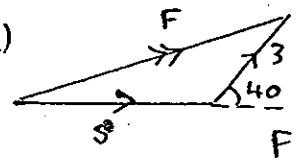
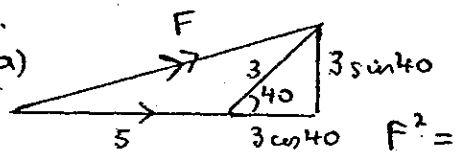
2.	EITHER	
	(a)  Vector Δ attempt	M1
	Correct	A1
	$F^2 = 5^2+3^2-2.5.3\cos 140$ (cos rule)	M1 A1
	$\rightarrow F \simeq \underline{7.55\ N}$	A1 (5)
	(b) $\frac{F}{\sin 140} = \frac{3}{\sin\theta} \Rightarrow \theta \simeq \underline{14.8^\circ}$	M1 A1, A1 (3)
		8
	OR. (a)  Vector Δ attempt correct	M1 A1
	$F^2 = (5+3\cos 40)^2 + (3\sin 40)^2$	M1 A1 ✓
	$F \simeq \underline{7.55\ N}$	A1 (5)
	(b) $\tan\theta = \frac{3\sin 40}{5+3\cos 40}$, $\theta \simeq \underline{14.8^\circ}$	M1 A1, ✓ A1 (3)
		8
	OR (a) $\underset{\sim}{P} = \begin{pmatrix}5\\0\end{pmatrix}$ or $5\underset{\sim}{i}$ $\underset{\sim}{Q} = \begin{pmatrix}3\cos 40\\3\sin 40\end{pmatrix}$ or $3\cos 40\underset{\sim}{i} + 3\sin 40\underset{\sim}{j}$	M1
	$\Rightarrow \underset{\sim}{F} = \begin{pmatrix}5+3\cos 40\\3\sin 40\end{pmatrix}$	A1
	$\lvert\underset{\sim}{F}\rvert = (5+3\cos 40)^2 + (3\sin 40)^2$	M1 A1 ✓
	$\simeq \underline{7.55\ N}$	A1 (5)
	(b) $\tan\theta = \frac{3\sin 40}{5+3\cos 40}$	M1 A1 ✓
	$\simeq \underline{14.8^\circ}$	A1 (3)
		8

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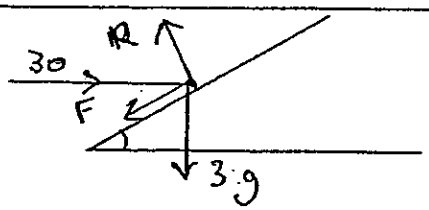
3.	(a) Distance $= \frac{1}{2} \times (30+17) \times 3, + 4 \times 17$	M1 A1, M1
	$= 138.5$ m.	A1 (4)
	OR $\frac{1}{2} \times 3 \times (30-17) + 3 \times 17 + 4 \times 17$	M1 A1, M1
	$= 138.5$ m	A1
	(b) Sr. line graph $\Rightarrow$ const. decel^n	M1
	"$F = ma$" $\Rightarrow$ F const	A1 cso (2)
	(c) Decel^n $= \frac{30-17}{3}$	M1
	Force $= 1200 \times \left(\frac{30-17}{3}\right) = 5200$ N	M1 A1 (3)
		(9)
4.	(a)  Diag. with 4 forces marked (Allow F & R combined if clear)	B2 −1 e.e. (2)
	(b) R(↑) $R = 3g \cos 30° + 30 \sin 30°$ (3 terms)	M1 A2 −1 e.e.
	$= 40.46\ldots \simeq 40.5$ or 40 N.	A1 (4)
	(c) R(↙) $F = 30 \cos 30° - 3g \sin 30°$ (3 terms)	M1 A1
	$F = \mu R, \Rightarrow \mu = \frac{F}{R} = \frac{11.28}{40.46}$	M1, M1
	$\simeq 0.28$ (or 0.279)	A1 (5)
		(11)

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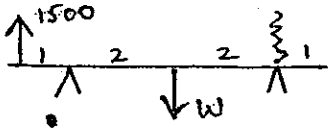
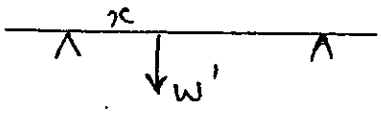
5.	(a) O	B1 (1)
	(b)  M(D): $2W = 1500.5$ $\Rightarrow W = 3750$ N	m1 A1 A1 (3)
	[If moments about another pt: M1 for a complete method to get W, A1 for a moments equ^2 correct.]	
	(c)  M(D) $1500.5 = W'(4-x)$ M(C) $1000.5 = W'x$ Solve $\rightarrow W' = 3125$ N	m1 A1 m1 A1 m1 A1 (6)
	(d) $x = 1.6$ m	m1 A1 (2)
	(e) AB remains straight line (o.e.)	B1 (1)
		13

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6.	(a) Car + Van: $3200a = 2320 - 800 - 240$ $a = 0.4\ ms^{-2}$	M1 A1 A1 (3)
	(b) Car: 240 ← • → T, a → $1200a = T - 240$ $\rightarrow T = 720\ N$	M1 A2√ −1 e.e. A1 (4)
	[OR Van: T ← 800, 2320 → $2000a = 2320 - 800 - T$ $\rightarrow T = 720$]	
	NB If use equ^{ns} for car + van alone, allow M1 A2 for one equ^{n} involving T, then M1 A1 for a second equ^{n} provided it is part of a complete method to find a/T. Then A1 A1 for a + T.	
	(c) a′ → 2320, 1040 ←, α ↓ 3200g $3200a' = 2320 - 1040 - 3200g \cdot \frac{1}{20}$ (4 terms) $a' = -0.09\ ms^{-2}$ $\Rightarrow$ magn. $0.09\ ms^{-2}$ speed decreasing	M1 A2 −1 e.e. M1 A1 A1√ (6) (13)

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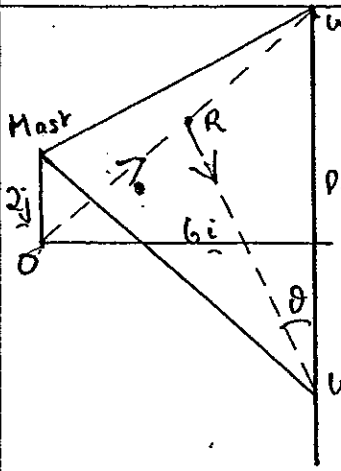
7.		
	(a) $\underset{\sim}{W_1} = 2\underset{\sim}{j} + 6\underset{\sim}{i} + 6\underset{\sim}{j}$	
	$= 6\underset{\sim}{i} + 8\underset{\sim}{j}$	B1 B1 (2)
	(b) $OW_1 = \sqrt{(6^2+8^2)} = 10$ km	M1
	Σ of r.v. time $= \frac{10}{5} = 2$ hrs	M1 A1 (3)
	(c) $\underset{\sim}{W_2} = 2\underset{\sim}{j} + 6\underset{\sim}{i} - 6\underset{\sim}{j}$	
	$= 6\underset{\sim}{i} - 4\underset{\sim}{j}$	B1, M1 A1 (3)
	(d) P.v. of rescue party after 1 hour = $\underset{\sim}{R} = 3\underset{\sim}{i} + 4\underset{\sim}{j}$	M1 A1
	$\underset{\sim}{RW_2} = 3\underset{\sim}{i} - 8\underset{\sim}{j}$	M1 A1
	$\tan\theta = \frac{3}{8} = 20.6°$	M1
	$\Rightarrow$ Required bearing $= 180° - 20.6°$	M1
	$= 159.4°$	A1 (7)
		(15)