EDEXCEL FOUNDATION

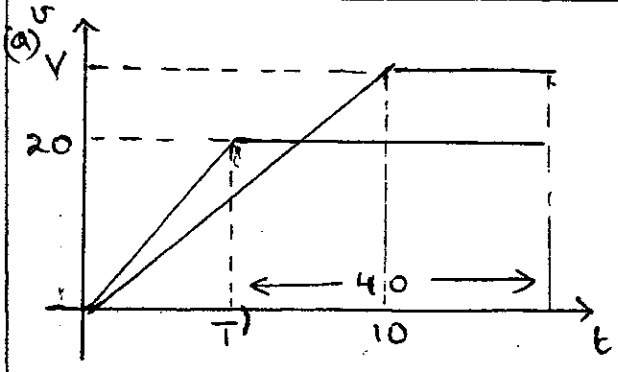
Stewart House 32 Russell Square London WC1B 5DN

January 2002

Advanced Supplementary/Advanced Level

General Certificate of Education

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

Question number	Scheme	Marks
1.	Impulse = Change in momᵐ = 0.3(8+6) = 4.2 Ns	M1 A1 A1 (3)
2.	(a) 4 → 1800 □ □ 1200 → V 1800.4 = (1800+1200)V V = 2.4 ms⁻¹	M1 A1 A1 (3)
	(b) R.8 = 3000.2.4 R = 900	M1 A1√(V) A1 (3) (6)
3.	(a) "v = u + at" : 60 = 12 + 4a → a = 12 ms⁻² (*)	M1 A1 (2)
	(b) "s = ut + ½at²" OA = 12.4 + ½.12.4² = 144 m	M1 A1 A1 (3)
	(c) "v² = u² + 2as" v² = 12² + 2.12.72 v ≈ 43.3 ms⁻¹	M1 A1√(OA) A1 (3)
4.	(a) 	One shape correct B1 2nd shape correct rel. to first B1 Figs (10, 20, 40) B1 (3)

Contd.

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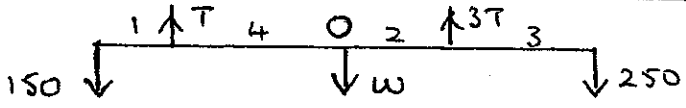
4.	(b) Scooter: dist travelled = area under graph $850 = \frac{1}{2}T.20 + 20.40$ $\Rightarrow T = \underline{5s}$	M1 A1 A1 (3)
	(c) Van: $850 = \frac{1}{2}V.10 + V(40-5)$ $\Rightarrow V = 21.25\ ms^{-1}$	M1 A1√ (T) A1 (3) (9)
5.	(a)  all rest	B1 B1 (2)
	(b) M(O): $150.5 + 3T.2 = T.4 + 250.5$ Solve $T = \underline{250\ N}$ [Allow M1 A2,1,0 for moments equ^{n} abt any pt. Then M1 A1 for complete sol^{n} → T=).	M1 A2,1,0 ↓ M1 A1 (5)
	(c) R(↑) $4T = 400 + W \rightarrow W = \underline{600\ N}$ (M1 needs complete sol^{n} → W=).	M1 A1 (2)
	(d) By having weight act at <u>centre/mid-pt</u>.	B1 (1) (10)
6.	(a) $\underline{F} = (6\underline{i} + 2\underline{j}) + (3\underline{i} - 5\underline{j}) = \underline{(9\underline{i} - 3\underline{j})}\ N$	B1 (1)
	(b)  $\tan\theta = \frac{9}{3} \Rightarrow \theta \simeq 71.6°$ $\phi = \underline{108.4°}$	M1 A1√ (F) A1 (3)
	(c) "$\underline{F} = m\underline{a}$" $\Rightarrow \underline{a} = \underline{(3\underline{i} - \underline{j})\ ms^{-2}}$	M1 A1√ (F) (2)
	(d) $\underline{v} = (-2\underline{i} + \underline{j}), + 2(3\underline{i} - \underline{j}), = 4\underline{i} - \underline{j}$ Speed $= \sqrt{(4^2 + 1^2)} \simeq \underline{4.12\ ms^{-1}}$	M1, M1, A1√ (a) M1 A1 (5) (11)

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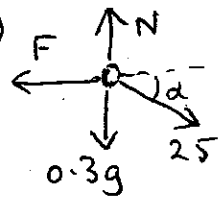
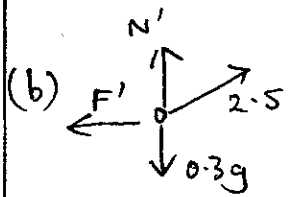
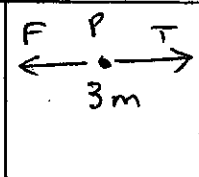
7.	(a) 	
	$R(\uparrow)$ $N = 0.3\times9.8 + 2.5\sin\alpha$ $(= 2.94 + 1.5 = 4.44\ N)$	M1 A2,1,0
	$R(\rightarrow)$ $F = 2.5\cos\alpha$ $(= 2\ N)$	M1 A1
	$F = \mu N \rightarrow \mu = \frac{2}{4.44} \simeq \underline{0.45}$	M1 M1 A1 (8)
	(b) 	
	$N' = 0.3\times9.8 - 2.5\sin\alpha = \underline{1.44\ N}$	M1 A1 (2)
	$F' \leq \mu N'$. $N' < N \Rightarrow F'_{max}$ less	M1
	But F' must $= 2.5\cos\alpha$ for equilib. Hence equilib. not possible	A1 cso (2) (12)
8.		
	(a) P: $T - F = 3ma$	M1 A1
	Q: $5mg - T = 5ma$	M1 A1 (4)
	(b) $F = 0.6\times3mg$ $(= 1.8mg)$	M1 A1
	Hence $5mg - 1.8mg = 8ma$	
	$a = \underline{0.4g}$	M1 A1 (4)
	(c) Sub: $T = 3ma + F$ or $5mg - 5ma$	
	$\rightarrow T = \underline{3mg}$	M1 A1 (2)
	(d) Speed when Q hits floor: $v^2 = 2\times0.4g\times h$	M1 A1√
	$= \frac{4}{5}gh$	
	Decel^2 of P: $3mf = 1.8mg \Rightarrow f = 0.6g$	M1 A1
	Dist moved by P: $\frac{4}{5}gh = 2.\frac{3}{5}g.s$	
	$\Rightarrow s = \underline{\frac{2}{3}h}$	M1 A1 (6) (16)