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Mark Scheme (Results)
January 2008

GCE

GCE Mathematics (6677/01)

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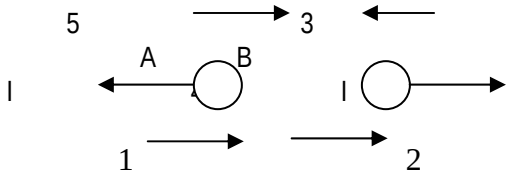
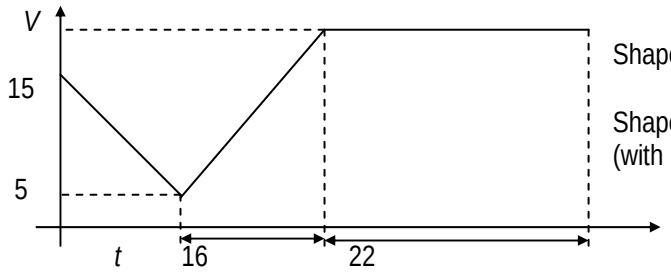
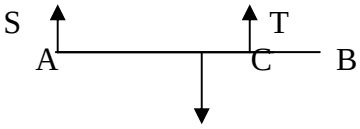
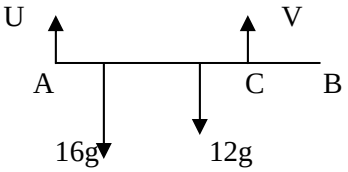
January 2008
6677 Mechanics M1
Mark Scheme

Question Number	Scheme	Marks
1(a)	. 	
	$I = 4(5 - 1) = \underline{16\ \text{Ns}}$	M1 A1 (2)
(b)	CLM: $4 \times 5 - m \times 3 = 4 \times 1 + m \times 2$	M1 A1
	$\Rightarrow m = \underline{3.2}$	DM1 A1 (4)
	or	**or**
	$16 = m(3 + 2)$	M1 A1
	$\Rightarrow \quad m = \underline{3.2}$	DM1 A1 (4) **6**
2.(a)	$27 = 0 + \frac{1}{2}.a.3^2 \quad \Rightarrow a = \underline{6}$	M1 A1 (2)
(b)	$v = 6 \times 3 = \underline{18\ \text{m s}^{-1}}$	M1 A1 f.t. (2)
(c)	From $t = 3$ to $t = 5$, $s = 18 \times 2 - \frac{1}{2} \times 9.8 \times 2^2$	M1 A1 f.t.
	Total ht. $= s + 27 = \underline{43.4\ \text{m},\ 43\ \text{m}}$	M1 A1 (4)
		8

Question Number	Scheme	Marks
3.(a)		B1 B1 B1 (3)
(b)	½(15 + 5) x t = 120 $\Rightarrow$ t = 12 $\rightarrow$ T = 12 + 16 + 22 = 50 s	M1 M1 A1 (3)
(c)	120 + ½(V + 5).16 + 22V = 1000 Solve: 30V = 840 $\Rightarrow$ V = 28	M1 B1 A1 DM1 A1 (5) **11**
4.(a)	R (// plane): 49 cos θ = 6g sin 30 $\Rightarrow$ cos θ = 3/5 *	M1 A1 A1 (3)
(b)	R (perp to plane): R = 6g cos 30 + 49 sin θ $R \approx$ 90.1 or 90 N	M1 A1 DM1 A1 (4)
(c)	R (// to plane): 49 cos 30 – 6g sin 30 = 6a $\Rightarrow$ $a \approx$ 2.17 or 2.2 m s^{-2}	M1 A2,1,0 A1 (4) **11**

Question Number	Scheme	Marks
5.(a)	 M(A): T x 4 = 12g x 2.5 T = <u>7.5g or 73.5 N</u> R(↑) $S + T = 12g$ $\Rightarrow$ S = <u>4.5g or 44.1 N</u>	M1 A1 A1 M1 A1 (5)
(b)	 M(A) V x 4 = 16g x y + 12g x 2.5 V = <u>4gy + 7.5g or 39.2y + 73.5 N</u>	M1 A1 A1 (3)
(c)	$V \leq 98 \Rightarrow 39.2y + 73.5 \leq 98$ $\Rightarrow y \leq 0.625 = 5/8$ Hence "load must be no more than 5/8 m from A" (o.e.)	M1 DM1 A1 (3) **11**
6.(a)	Speed = $\sqrt{(5^2 + 8^2)} \approx$ <u>9.43 m s^{-1}</u>	M1 A1 (2)
(b)	Forming arctan 8/5 or arctan 5/8 oe Bearing = 360 – arctan 5/8 or 270 + arctan 8/5 = <u>328</u>	M1 DM1 A1 (3)
(c)	At t = 3, p.v. of P = (7 – 15)**i** + (–10 + 24)**j** = –8**i** + 14**j** Hence –8**i** + 14**j** + 4(u**i** + v **j**) = **0** $\Rightarrow$ <u>u = 2, v = – 3.5</u>	M1 A1 M1 DM1 A1 (5)
(d)	p.v. of P t secs after changing course = (–8**i** + 14**j**) + t(2**i** – 3.5**j**) = 7**i** + ….. Hence total time = <u>10.5 s</u>	M1 DM1 A1 (3) **13**

Question Number	Scheme	Marks
7.(a)	B: $2mg - T = 2m \times 4g/9$	M1 A1
	$\Rightarrow T = \underline{10mg/9}$	A1 (3)
(b)	A: $T - \mu mg = m \times 4g/9$	M1 B1 A1
	Sub for T and solve: $\mu = 2/3$ *****	DM1 A1 (5)
(c)	When B hits: $v^2 = 2 \times 4g/9 \times h$	M1 A1
	Deceleration of A after B hits: $ma = \mu mg \Rightarrow a = 2g/3$	M1 A1 f.t.
	Speed of A at P: $V^2 = 8gh/9 - 2 \times 2g/3 \times h/3$	DM1
	$\Rightarrow V = \frac{2}{3}\sqrt{(gh)}$	A1 (6)
(d)	Same tension on A and B	B1 (1)
		15