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Mark Scheme (Results)
January 2008

GCE

GCE Mathematics (6677/01)

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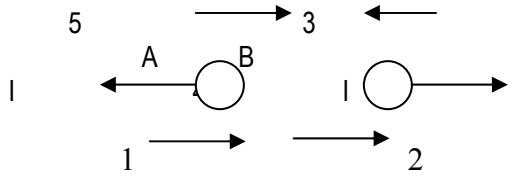
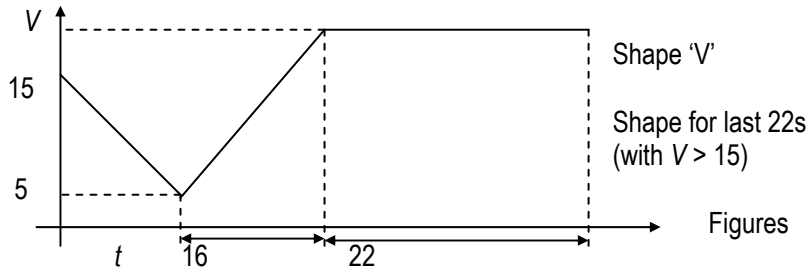
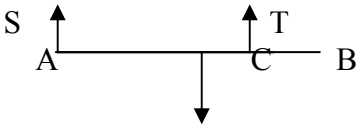
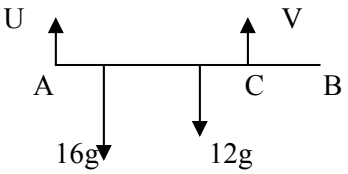
January 2008
6677 Mechanics M1
Mark Scheme

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

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

Question Number	Scheme	Marks
5.(a)	 M(A): T x 4 = 12g x 2.5 T = 7.5g or 73.5 N R(↑) $S + T = 12g$ $\Rightarrow$ S = 4.5g or 44.1 N	M1 A1 A1 M1 A1 (5)
(b)	 M(A) V x 4 = 16g x y + 12g x 2.5 V = 4gy + 7.5g or 39.2y + 73.5 N	M1 A1 A1 (3)
(c)	$V \le 98 \Rightarrow 39.2y + 73.5 \le 98$ $\Rightarrow y \le 0.625 = 5/8$ Hence "load must be no more than 5/8 m from A" (o.e.)	M1 DM1 A1 (3) **11**
6.(a)	Speed = $\sqrt{(5^2 + 8^2)} \approx$ 9.43 m s^{-1}	M1 A1 (2)
(b)	Forming arctan 8/5 or arctan 5/8 oe Bearing = 360 – arctan 5/8 or 270 + arctan 8/5 = 328	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** $\Rightarrow$ $u = 2$, $v = -3.5$	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 = 10.5 s	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