

Mark Scheme (Results)

Summer 2009

GCE

GCE Mathematics (6677/01)

June 2009
6677 Mechanics M1
Mark Scheme

| Question Number | Scheme | Marks |
|-----------------|---|--|
| Q1 | $45 = 2u + \frac{1}{2}a2^2 \Rightarrow 45 = 2u + 2a$ $165 = 6u + \frac{1}{2}a6^2 \Rightarrow 165 = 6u + 18a$ <p style="text-align: center;">eliminating either u or a</p> $u = 20 \text{ and } a = 2.5$ | M1 A1 M1 A1 M1 A1 A1 [7] |
| Q2 (a) (b) | $\tan \theta = \frac{p}{2p} \Rightarrow \theta = 26.6^\circ$ $\mathbf{R} = (\mathbf{i} - 3\mathbf{j}) + (p\mathbf{i} + 2p\mathbf{j}) = (1 + p)\mathbf{i} + (-3 + 2p)\mathbf{j}$ <p style="text-align: center;">\mathbf{R} is parallel to $\mathbf{i} \Rightarrow (-3 + 2p) = 0$</p> $\Rightarrow p = \frac{3}{2}$ | M1 A1 (2) M1 A1 DM1 A1 (4) [6] |
| Q3 (a) (b) | <p>For A:</p> $-\frac{7mu}{2} = 2m(v_A - 2u)$ $v_A = \frac{u}{4}$ <p>For B:</p> $\frac{7mu}{2} = m(v_B - -3u)$ $v_B = \frac{u}{2}$ <p>OR CLM:</p> $4mu - 3mu = 2m\frac{u}{4} + mv_B$ $v_B = \frac{u}{2}$ | M1 A1 A1 (3) M1 A1 A1 (3) OR M1 A1 A1 (3) [6] |

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| Q4 | $0.5g \sin \theta - F = 0.5a$ $F = \frac{1}{3}R \text{ seen}$ $R = 0.5g \cos \theta$ <p>Use of $\sin \theta = \frac{4}{5}$ or $\cos \theta = \frac{3}{5}$ or decimal equiv or decimal angle e.g 53.1° or 53°</p> $a = \frac{3g}{5} \text{ or } 5.88 \text{ m s}^{-2} \text{ or } 5.9 \text{ m s}^{-2}$ | M1 A1 A1 B1 M1 A1 B1 DM1 A1 [9] |
| Q5 | $F = P \cos 50^\circ$ $F = 0.2R \text{ seen or implied.}$ $P \sin 50^\circ + R = 15g$ <p>Eliminating R; Solving for P ; $P = 37 \text{ (2 SF)}$</p> | M1 A1 B1 M1 A1 A1 DM1; D M1; A1 [9] |
| Q6 (a) (b) OR: (c) | <p>For whole system: $1200 - 400 - 200 = 1000a$</p> $a = 0.6 \text{ m s}^{-2}$ <p>For trailer: $T - 200 = 200 \times 0.6$</p> $T = 320 \text{ N}$ <p>OR: For car: $1200 - 400 - T = 800 \times 0.6$</p> $T = 320 \text{ N}$ <p>For trailer: $200 + 100 = 200f \text{ or } -200f$</p> $f = 1.5 \text{ m s}^{-2} \text{ (-1.5)}$ <p>For car: $400 + F - 100 = 800f \text{ or } -800f$</p> $F = 900$ <p>(N.B. For both: $400 + 200 + F = 1000f$)</p> | M1 A1 A1 (3) M1 A1 ft A1 OR: M1 A1 ft A1 (3) M1 A1 A1 M1 A2 A1 (7) [13] |

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| Q7 (a) | $M(Q), 50g(1.4 - x) + 20g \times 0.7 = T_p \times 1.4$ $T_p = 588 - 350x \quad \text{Printed answer}$ | M1 A1 A1 (3) |
| (b) | $M(P), 50gx + 20g \times 0.7 = T_Q \times 1.4 \quad \text{or} \quad R(\uparrow), T_p + T_Q = 70g$ $T_Q = 98 + 350x$ | M1 A1 A1 (3) |
| (c) | $\text{Since } 0 < x < 1.4, \quad 98 < T_p < 588 \text{ and } 98 < T_Q < 588$ | M1 A1 A1 (3) |
| (d) | $98 + 350x = 3(588 - 350x)$ $x = 1.19$ | M1 DM1 A1 (3) [12] |
| Q8 (a) | $ \mathbf{v} = \sqrt{1.2^2 + (-0.9)^2} = 1.5 \text{ m s}^{-1}$ | M1 A1 (2) |
| (b) | $(\mathbf{r}_H =) 100\mathbf{j} + t(1.2\mathbf{i} - 0.9\mathbf{j}) \text{ m}$ | M1 A1 (2) |
| (c) | $(\mathbf{r}_K =) 9\mathbf{i} + 46\mathbf{j} + t(0.75\mathbf{i} + 1.8\mathbf{j}) \text{ m}$ | M1 A1 |
| (d) | $\overrightarrow{HK} = \mathbf{r}_K - \mathbf{r}_H = (9 - 0.45t)\mathbf{i} + (2.7t - 54)\mathbf{j} \text{ m} \quad \text{Printed Answer}$ <p>Meet when $\overrightarrow{HK} = \mathbf{0}$</p> $(9 - 0.45t) = 0 \quad \text{and} \quad (2.7t - 54) = 0$ $t = 20 \text{ from both equations}$ $\mathbf{r}_K = \mathbf{r}_H = (24\mathbf{i} + 82\mathbf{j}) \text{ m}$ | M1 A1 A1 DM1 A1 cso (5) [13] |