

Mark Scheme (Results)

January 2007

GCE

GCE Mathematics

Mechanics M1 (6677)



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Question Number	Scheme	Marks
1.	(a) $P \sin 30^\circ = 24$ $P = 48$ (b) $Q = P \cos 30^\circ$ ≈ 41.6 accept $24\sqrt{3}$, awrt 42	M1 A1 A1 <u>3</u> M1 A1 A1 <u>3</u> 6
2.	(a) M(C) $80 \times x = 120 \times 0.5$ $x = 0.75$ * cso (b) Using reaction at C = 0 M(D) $120 \times 0.25 = W \times 1.25$ ft their x $W = 24$ (N) (c) i $X = 24 + 120 = 144$ (N) ft their W (d) The weight of the rock acts precisely at B.	M1 A1 A1 <u>3</u> B1 M1 A1 A1 <u>4</u> M1 A1ft <u>2</u> B1 <u>1</u> 10
3.	(a) $\mathbf{a} = \frac{(15\mathbf{i} - 4\mathbf{j}) - (3\mathbf{i} + 2\mathbf{j})}{4} = 3\mathbf{i} - 1.5\mathbf{j}$ (b) N2L $\mathbf{F} = m\mathbf{a} = 6\mathbf{i} - 3\mathbf{j}$ ft their $\mathbf{a}$ $\mathbf{F} = \sqrt{(6^2 + 3^2)} \approx 6.71$ (N) accept $\sqrt{45}$, awrt 6.7 (c) $\mathbf{v}_6 = (3\mathbf{i} + 2\mathbf{j}) + (3\mathbf{i} - 1.5\mathbf{j})6$ ft their $\mathbf{a}$ $= 21\mathbf{i} - 7\mathbf{j}$ (ms^{-1})	M1 A1 <u>2</u> M1 A1 M1 A1 <u>4</u> M1 A1ft A1 <u>1</u> 9

Question Number	Scheme	Marks
4.	(a) CLM $0.3u = 0.3 \times (-2) + 0.6 \times 5$ $u = 8$ (b) $I = 0.6 \times 5 = 3 \text{ (Ns)}$ (c) $v = u + at \Rightarrow 5 = a \times 1.5 \text{ (} a = \frac{10}{3} \text{)}$ N2L $R = 0.6 \times \frac{10}{3} = 2$	M1 A1 M1 A1 <u>4</u> M1 A1 <u>2</u> M1 A1 M1 A1 <u>4</u> 10
5.	(a) $v^2 = u^2 + 2as \Rightarrow 0^2 = 21^2 - 2 \times 9.8 \times h$ $h = 22.5 \text{ (m)}$ (b) $v^2 = u^2 + 2as \Rightarrow v^2 = 0^2 + 2 \times 9.8 \times 24$ or equivalent $(= 470.4)$ $v \approx 22 \text{ (ms}^{-1}\text{)}$ accept 21.7 (c) $v = u + at \Rightarrow -\sqrt{470.4} = 21 - 9.8t$ or equivalent – 1 each error $t \approx 4.4 \text{ (s)}$ accept 4.36	M1 A1 A1 <u>3</u> M1 A1 A1 <u>3</u> M1 A2 (1, 0) – 1 each error A1 <u>4</u> 10

Question Number	Scheme	Marks
6.	(a) Use of $F = \mu R$ $P \cos 20^\circ = \mu R$ i $R + P \sin 20^\circ = 30g$ $P \cos 20^\circ = \mu(30g - P \sin 20^\circ)$ $P = \frac{0.4 \times 30g}{\cos 20^\circ + 0.4 \sin 20^\circ}$ $\approx 110 \text{ (N)}$ accept 109 (b) i $R + 150 \sin 20^\circ = 30g$ $(R \approx 242.7)$ N2L $\quad \quad 150 \cos 20^\circ - \mu R = 30a$ $a \approx \frac{150 \cos 20^\circ - 0.4 \times 242.7}{30}$ $= 1.5 \text{ (ms}^{-2}\text{)}$ accept 1.46	B1 M1 A1 M1 A1 M1 M1 A1 <u>8</u> M1 A1 M1 A1 M1 A1 <u>6</u> 14

Question Number	Scheme	Marks
7.	(a) N2L Q $2g - T = 2a$ N2L P $T - 3g \sin 30^\circ = 3a$ (b) $2g - 3g \sin 30^\circ = 5a$ $a = 0.98 \text{ (ms}^{-2}\text{)} \star$ cso (c) $T = 2(g - a)$ or equivalent $\approx 18 \text{ (N)}$ accept 17.6 (d) The (magnitudes of the) accelerations of P and Q are equal (e) $v^2 = u^2 + 2as \Rightarrow v^2 = 2 \times 0.98 \times 0.8 \text{ (=1.568)}$ $v \approx 1.3 \text{ (ms}^{-1}\text{)}$ accept 1.25 (f) N2L for P $-3g \sin 30^\circ = 3a$ $a = (-)\frac{1}{2}g$ $s = ut + \frac{1}{2}at^2 \Rightarrow 0 = \sqrt{1.568}t - \frac{1}{2}4.9t^2$ or equivalent $t = 0.51 \text{ (s)}$ accept 0.511 <i>A maximum of one mark can be lost for giving too great accuracy.</i>	M1 A1 M1 A1 <u>4</u> M1 A1 <u>2</u> M1 A1 <u>2</u> B1 <u>1</u> M1 A1 <u>2</u> M1 A1 M1 A1 A1 <u>5</u> 16