

MECHANICS 2 (A) TEST PAPER 2 : ANSWERS AND MARK SCHE



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|----|--|--|----|
| 1. | $F = \frac{1}{4}(0.2g) = 0.49 \text{ N}$ $W = Fd = 0.49 \times 0.5 = 0.245 \text{ J}$ | M1 A1 M1 A1 | |
| 2. | $0 = 10^2 + 2a(37.5)$ $a = -13.3 \text{ ms}^{-2}$
Resisting force = $0.9(13.3 - 9.8) = 3.18 \text{ N}$ | M1 A1
M1 A1 A1 | 5 |
| 3. | (a) When $x = 0$, $t(3t + 8) = 0$ No solution for $t > 0$
(b) $v = 6t + 8$ When $v = 20$, $6t = 12$ $t = 2$
(c) $a = 6$, constant $F = 0.4 \times 6 = 2.4 \text{ N}$ | M1 A1
M1 A1 A1
B1 M1 A1 | 8 |
| 4. | (a) Impulse = $2m[(5\mathbf{i} + \mathbf{j}) - (3\mathbf{i} - \mathbf{j})] = 2m(2\mathbf{i} + 2\mathbf{j})$
Magnitude = $4m\sqrt{2} \text{ N s}$ or $5.66m \text{ N s}$
(b) $2m(3\mathbf{i} - \mathbf{j}) + 3m(4\mathbf{i} + \mathbf{j}) = 2m(5\mathbf{i} + \mathbf{j}) + 3m\mathbf{v}_B$
$3\mathbf{v}_B = 8\mathbf{i} - \mathbf{j}$ $ \mathbf{v}_B = \frac{1}{3}\sqrt{65}$ Speed of B = 2.69 ms^{-1} | M1 A1
M1 A1
M1 A1
M1 A1 A1 | 9 |
| 5. | (a) $25000 = 15(900 + 850a)$ $a = 0.902 \text{ ms}^{-2}$
(b) $25000 = 900 v_{\max}$ $v_{\max} = 27.8 \text{ ms}^{-1}$
(c) $25000 = v(85g + 900)$ $v = 14.4 \text{ ms}^{-1}$ | M1 A1 A1
M1 A1 A1
M1 A1 M1 A1 | 10 |
| 6. | (a) $\sin C = \frac{3}{5}$ so $\cos C = \frac{4}{5}$ (3, 4, 5 Δ)
(b) (i) $3a(0) + 10a(5a) + 5a(8a) = 18a\bar{x}$ $\bar{x} = 5a$
(ii) $3a(1.5a) + 10a(0) + 5a(1.5a) = 18a\bar{y}$ $\bar{y} = \frac{2a}{3}$
(c) $\tan \alpha = \frac{2a}{3} \div 5a = \frac{2}{15}$ $\alpha = 7.6^\circ$ | M1 A1
M1 A1 A1
M1 A1 A1
M1 A1 M1 A1 | 12 |
| 7. | Momentum : $1.2 + 0.2u = 0.3v + 0.4$ $3v - 2u = 8$
Elasticity : $(2 - v)/(u - 4) = -\frac{1}{3}$ $3v - u = 2$
Solve : $u = -6$, $v = -\frac{4}{3}$
(a) Q before collision : 6 ms^{-1} (b) P after collision : $\frac{4}{3} \text{ ms}^{-1}$
(c) K.E. before = $0.15(16) + 0.1(36) = 6 \text{ J}$
K.E. after = $0.15(\frac{16}{9}) + 0.1(4) = \frac{2}{3} \text{ J}$ Loss = $5\frac{1}{3} \text{ J}$ | M1 A1
M1 A1
A1 A1
A1 A1
M1 A1
M1 A1 | 12 |
| 8. | (a) $x = 8 \cos 30^\circ t$ When $x = 6$, $t = 0.866 \text{ s}$
(b) Then $y = 8 \sin 30^\circ t - 4.9t^2 = -0.21 \text{ m}$, so does not hit coconut
(c) When $v_y = 0$, $8 \sin 30^\circ - 9.8t = 0$ $t = 0.408$
Then $y = 4(0.408) - 4.9(0.408^2) = 0.816 \text{ m}$
(d) Max range when projected at 45° $y = 0$ when $t = 1.154$
Then $x = 1.154(8 \cos 45^\circ) = 6.53 \text{ m}$
(e) Ball = particle; assumed gravity is only force acting on ball | M1 A1
M1 A1 M1 A1
M1 A1
M1 A1
B1 M1
A1
B1 B1 | 15 |