

MECHANICS 2 (A) TEST PAPER 8 : ANSWERS AND MARK SCHEM

1. Rebound speed = $0.4(4) = 1.6 \text{ ms}^{-1}$ K.E. lost = $\frac{1}{2} \times 2 \times (4^2 - 1.6^2) = 13.4 \text{ J}$	M1 A1 M1 A1 A1	5
2. (a) When $v = 0$, $4t^2 = 9$ $t = 1.5$ $a = 8t = 12 \text{ ms}^{-2}$ (b) $s = \int_0^{1.5} v \, dt = \left[\frac{4}{3} t^3 - 9t \right]_0^{1.5} = 4.5 - 13.5$, so distance = 9 m	M1 A1 A1 M1 M1 A1 A1	7
3. (a) $\mathbf{v} = e^t \mathbf{i} - 2\mathbf{j}$ (b) $\mathbf{a} = e^t \mathbf{i}$, so always in i-direction (c) When $ \mathbf{a} = 12$, $t = \ln 12 = 2.48 \text{ s}$	M1 A1; M1 A1 M1 A1 A1	7
4. Let R = reaction at wall Resolve horizontally : $R = 12\mu$ Resolve vertically : $12 + \mu R = 1.4g$ Hence $12 + 12\mu^2 = 1.4g$ $1 + \mu^2 = 1.143$ $\mu = 0.38$	M1 A1 M1 A1 M1 A1 M1 A1	8
5. (a) $25920 = k(36^2)(36)$ $k = 25920 \div 36^3 = \frac{5}{9}$ (b) $25920 = 25\left(\frac{5}{9}(25)^2 + 460a\right)$ $a = 1.50 \text{ ms}^{-2}$	M1 A1 M1 A1 M1 A1 A1 M1 A1	9
6. (a) PQR is a 3, 4, 5 Δ so angle $PQR = 90^\circ$ By property of medians, distances are (i) $\frac{1}{3} \times 24 = 8 \text{ cm}$ from PQ (ii) $\frac{1}{3} \times 18 = 6 \text{ cm}$ from QR (b) Equilibrium is about to be broken when G is above Q Then $\tan \theta = 8/6$ $\theta = 53.1^\circ$	B1 M1 A1 M1 A1 M1 M1 A1 A1	9
7. (a) Momentum : $36m - 24m = 9mv_A + 4mv_B$ $9v_A + 4v_B = 12$ $v_A > 0$, so $4v_B < 12$ $v_B < 3$ (b) $(v_B - v_A)/(-6 - 4) = -e$ $e = (v_B - v_A) / 10$ Now $v_B - v_A < v_B < 3$, so $e < \frac{3}{10}$ (c) If $e = 0$, $v_B = v_A$ $13v_A = 12$ $v_A = v_B = \frac{12}{13} \text{ ms}^{-1}$	M1 A1 A1 M1 A1 M1 A1 M1 A1 A1 M1 M1 A1 A1	14
8. (a) $600 = \frac{1}{2}gt^2$ $t = \sqrt{122.45} = 11.1 \text{ s}$ (b) $x = 55t = 608.6 \text{ m}$ (c) $v_x = 55$, $v_y = gt = 108.4$ $v = \sqrt{(v_x^2 + v_y^2)} = \sqrt{14785} = 121.6$ $121.6 < 125$ so packet does not split open (d) Need $v_x^2 + 108.4^2 = 125^2 = 15625$ so $v_x = 62.2 \text{ ms}^{-1}$ (e) 11.1 s, as in (a) (f) Leaflet is likely to drift due to wind and air resistance, so particle model is not appropriate	M1 A1 A1 M1 A1 M1 A1 M1 A1 A1 M1 A1 A1 A1 B1 B1	16