

MECHANICS 1 (A) TEST PAPER 6 : ANSWERS AND MARK SCHEME

1. $F = 0.34 \text{ N}$ at dist. d from X , where $0.34d = 0.2 \times 1.5 + 0.14 \times 2$ B1 M1 A1
 $0.34d = 0.58$ $d = 1.71 \text{ m}$ or 171 cm A1 M1 A1 6
2. (a) At P , $v = 9 + 3.6t$ At Q , $v = 9 + 3.6t + 2t = 9 + 5.6t$ M1 A1
 $9 + 5.6t = 16$ $5.6t = 7$ $t = 1.25$ O to Q : 2.5 s M1 A1
 (b) $\frac{1}{2} \times 1.25 \times (9 + 13.5 + 13.5 + 16) = 32.5 \text{ m}$ M1 A1 A1 7
3. (a) Resolve : $F \sin 60^\circ = T \sin 30^\circ$, $F \cos 60^\circ + T \cos 30^\circ = 0.8g$ M1 A1 A1
 Hence $F\sqrt{3} = T$, $F + T\sqrt{3} = 1.6g$ $4F = 1.6g$ $F = 3.92 \text{ N}$ M1 M1 A1
 (b) $T = 3.92\sqrt{3} = 6.79 \text{ N}$ M1 A1
 (c) Modelled clay as a particle B1 9
4. (a) Momentum : $7 \times 50 - 4y = 2.25(50 + y)$ $6.25y = 237.5$ $y = 38$ M1 A1 A1
 Impulse = $0.05(7 - 2.25) = 0.238 \text{ Ns}$ M1 A1
 (b) Momentum : $7 \times 50 - 4y = -5 \times 50 + 5y$ $9y = 600$ $y = 66\frac{2}{3}$ M1 A1 A1
 Impulse = $0.05 \times 12 = 0.6 \text{ Ns}$ M1 A1 10
5. (a) $0 = 7^2 - 2a(4)$ $a = \frac{49}{8} \text{ ms}^{-2}$ M1 A1
 (b) Acc down plane = $g \sin 25^\circ + \mu g \cos 25^\circ = 9.8(\sin 25^\circ + \mu \cos 25^\circ)$ M1 A1
 Hence $\sin 25^\circ + \mu \cos 25^\circ = 0.625$ $\mu = 0.223$ M1 A1
 (c) Now down plane, acc. = $g \sin 25^\circ - \mu g \cos 25^\circ = 0.220g$ M1 A1
 $v^2 = 0 + 2(4)(0.220g) = 17.27$ $v = 4.16 \text{ ms}^{-1}$ M1 A1
 (d) Air resistance, which would make the answer smaller B1 B1 12
6. (a) $\vec{AB} = -50\mathbf{i} + 120\mathbf{j}$, which has magnitude 130 M1 A1
 $\vec{v}_c = \frac{2.6}{130}(-50\mathbf{i} + 120\mathbf{j}) = (-\mathbf{i} + 2.4\mathbf{j}) \text{ ms}^{-1}$ M1 A1
 (b) $\vec{OB} = -20\mathbf{i} + 60\mathbf{j}$, of magnitude $\sqrt{4000} = 20\sqrt{10}$ M1 A1
 $\vec{v}_D = \frac{k\sqrt{10}}{20\sqrt{10}}(-20\mathbf{i} + 60\mathbf{j}) = k(-\mathbf{i} + 3\mathbf{j}) \text{ ms}^{-1}$ M1 A1
 (c) Posn. vectors at time t are $(30 - t)\mathbf{i} + (2.4t - 60)\mathbf{j}$ and $kt(-\mathbf{i} + 3\mathbf{j})$ B1 B1
 When these are equal, $30 - t = -kt$ and $2.4t - 60 = 3kt$ M1
 $-60 + 2.4t = -3(30 - t)$ $t = 50$ $k = 0.4$ A1 M1 A1 14
7. (a) $4.5g - T = 4.5a$, $T - 4g = 4a$ Add : $0.5g = 8.5a$ $a = 0.576 \text{ ms}^{-2}$ M1 A1 A1 M1 A1
 (b) $v^2 = 2as = 2(0.576)(1.9) = 2.191$ $v = 1.48 \text{ ms}^{-1}$ M1 A1 A1
 (c) P has risen 1.9 m and has speed 1.48 ms^{-1} B1
 Under gravity P rises $s \text{ m}$ where $0 = 1.48^2 - 2(9.8)s$ M1 A1 A1
 $s = 0.112 \text{ m} < 1.1 \text{ m}$, so P does not hit the pulley M1 A1
 (d) Momentum conserved : $4(1.48) + 4.5(0) = 8.5v$ $v = 0.697 \text{ ms}^{-1}$ M1 A1 A1 17