

MECHANICS 1 (A) TEST PAPER 8 : ANSWERS AND MARK SCHEME

1. (a) $s = \frac{1}{2}gt^2 = \frac{1}{2} \times 9.8 \times 1.7^2 = 14.2 \text{ m}$ M1 A1 A1
 (b) Lighter ball may be more affected by air resistance : include this B1 B1 5
2. (a) $R = 5g + 8g = 13g = 127.4 \text{ N}$ M1 A1
 (b) $M(X) : 5g \times d + 8g \times 4a = 13g \times 3a \quad 5d = 7a \quad d = 1.4a$ M1 A1 A1 5
3. (a) Total force to north = $9 \cos 30^\circ - 12 \cos 45^\circ = -0.691 \text{ N}$ M1 A1
 Total force to east = $9 \sin 30^\circ - 12 \sin 45^\circ = -3.985 \text{ N}$ M1 A1
 So $\mathbf{R} = 3.99\mathbf{i} + 0.69\mathbf{j} \quad a = 3.99, b = 0.69$ A1
 (b) $|\mathbf{R}| = \sqrt{(3.985^2 + 0.691^2)} = 4.04 \text{ N}, \text{ at } \tan^{-1} 5.77 = 080.1^\circ$ M1 A1 M1 A1 9
4. (a) $\text{Acc} = g \sin 60^\circ = 8.49 \text{ ms}^{-2} \quad v^2 = 2as = 16.97 \quad v = 4.12 \text{ ms}^{-1}$ M1 A1 M1 A1
 (b) $T - g \sin 60^\circ = a, \quad Mg - T = Ma \quad a = \frac{g}{5}$ M1 A1 A1
 Add : $Mg - g \sin 60^\circ = M\frac{g}{5} + \frac{g}{5} \quad M(\frac{4g}{5}) = \frac{g}{5} + g\frac{\sqrt{3}}{2}$ M1 A1
 $\times 10, \div g : 8M = 2 + 5\sqrt{3} \quad M = (5\sqrt{3} + 2)/8$ M1 A1
 (c) Assumed pulley is smooth. If not, tensions in two sections of string are not equal B1 13
5. (a) Impulse = $0.2 \times 3 = 0.6 \text{ Ns}$ M1 A1 B1
 (b) $200 \times 5 - 4k = 200 \times 2 + 5k \quad 9k = 600 \quad k = 66\frac{2}{3}$ M1 A1 A1
 (c) $v = u + at : 0 = 5 + 3a \quad a = -\frac{5}{3} \quad \mu g = \frac{5}{3} \quad \mu = 0.170$ M1 A1 M1 A1
 (d) $v^2 = u^2 + 2as : 0 = 4 + 2(-\frac{5}{3})s \quad s = 1.2 \text{ m}$ M1 A1 A1 13
6. (a) Resolve horizontally : $T + \frac{2R}{7\sqrt{2}} = \frac{R}{\sqrt{2}} \quad T = \frac{5R}{7\sqrt{2}}$ M1 A1 A1
 Resolve vertically : $mg = \frac{R}{\sqrt{2}} + \frac{2R}{7\sqrt{2}} = \frac{9R}{7\sqrt{2}} \quad R = \frac{7\sqrt{2}}{9}mg$ M1 A1 A1
 $T = \frac{5}{7\sqrt{2}} \times \frac{7\sqrt{2}}{9}mg = \frac{5mg}{9}$ M1 A1
 (b) Down wire : $\frac{mg}{\sqrt{2}} - \frac{2}{7} \frac{mg}{\sqrt{2}} = ma \quad a = \frac{5g}{7\sqrt{2}} = 4.95 \text{ ms}^{-2}$ M1 A1 M1 A1
 $s = \frac{1}{2}at^2 : 0.1 = 2.475t^2 \quad t^2 = 0.0404 \quad t = 0.201 \text{ s}$ M1 A1 A1 15
7. (a) B3 B3
- (b) Areas under graphs equal : $40(0.2T) = 1.75(T + 80)$ M1 A1 A1
 $6.25T = 140 \quad T = 22.4$ M1 A1
- (c) Area = $8T$, so distance = 179.2 m M1 A1
- (d) $3.5 + (80 - T) = 0.0608 \text{ ms}^{-2}$ M1 A1 15