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

1. (a) $s = \frac{1}{2}gt^2 = \frac{1}{2} \times 9{\cdot}8 \times 1{\cdot}7^2 = 14{\cdot}2$ m — M1 A1 A1

   (b) Lighter ball may be more affected by air resistance : include this — B1 B1 — 5

2. (a) $R = 5g + 8g = 13g = 127{\cdot}4$ N — M1 A1

   (b) M(X) : $5g \times d + 8g \times 4a = 13g \times 3a$ $\quad 5d = 7a \quad d = 1{\cdot}4a$ — M1 A1 A1 — 5

3. (a) Total force to north $= 9\cos 30° - 12\cos 45° = -0{\cdot}691$ N — M1 A1

   Total force to east $= 9\sin 30° - 12\sin 45° = -3{\cdot}985$ N — M1 A1

   So $\mathbf{R} = 3{\cdot}99\mathbf{i} + 0{\cdot}69\mathbf{j}$ $\quad a = 3{\cdot}99,\ b = 0{\cdot}69$ — A1

   (b) $|\mathbf{R}| = \sqrt{(3{\cdot}985^2 + 0{\cdot}691^2)} = 4{\cdot}04$ N, at $\tan^{-1} 5{\cdot}77 = 080{\cdot}1°$ — M1 A1 M1 A1 — 9

4. (a) Acc $= g\sin 60° = 8{\cdot}49$ ms^{-2} $\quad v^2 = 2as = 16{\cdot}97 \quad v = 4{\cdot}12$ ms^{-1} — M1 A1 M1 A1

   (b) $T - g\sin 60° = a$, $\quad Mg - T = Ma \quad a = \frac{g}{5}$ — M1 A1 A1

   Add : $Mg - g\sin 60° = M\frac{g}{5} + \frac{g}{5} \quad M(\frac{4g}{5}) = \frac{g}{5} + g\frac{\sqrt{3}}{2}$ — M1 A1

   x 10, ÷ 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 — B1

   of string are not equal — B1 — 13

5. (a) Impulse $= 0{\cdot}2 \times 3 = 0{\cdot}6$ 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) $v = u + at$: $0 = 5 + 3a \quad a = -\frac{5}{3} \quad \mu g = \frac{5}{3} \quad \mu = 0{\cdot}170$ — M1 A1 M1 A1

   (d) $v^2 = u^2 + 2as$: $0 = 4 + 2(-\frac{5}{3})s \quad s = 1{\cdot}2$ m — M1 A1 A1 — 13

6. (a) Resolve horizontally : $T + \frac{2}{7}\frac{R}{\sqrt{2}} = \frac{R}{\sqrt{2}} \quad T = \frac{5R}{7\sqrt{2}}$ — M1 A1 A1

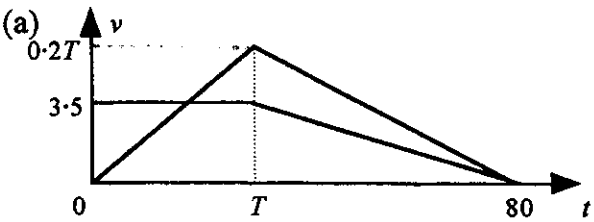
   Resolve vertically : $mg = \frac{R}{\sqrt{2}} + \frac{2}{7}\frac{R}{\sqrt{2}} = \frac{9R}{7\sqrt{2}} \quad R = \frac{7\sqrt{2}}{9}mg$ — M1 A1 A1

   $T = \frac{5}{7\sqrt{2}} \times \frac{7\sqrt{2}}{9}mg = \frac{5mg}{9}$ — M1 A1

   (b) Down wire : $\frac{mg}{\sqrt{2}} - \frac{2}{7}\frac{mg}{\sqrt{2}} = ma \quad a = \frac{5g}{7\sqrt{2}} = 4{\cdot}95$ ms^{-2} — M1 A1 M1 A1

   $s = \frac{1}{2}at^2$: $\quad 0{\cdot}1 = 2{\cdot}475t^2 \quad t^2 = 0{\cdot}0404 \quad t = 0{\cdot}201$ s — M1 A1 A1 — 15

7. (a)



   B3 B3

   (b) Areas under graphs equal : $40(0{\cdot}2T) = 1{\cdot}75(T + 80)$ — M1 A1 A1

   $6{\cdot}25T = 140 \quad T = 22{\cdot}4$ — M1 A1

   (c) Area $= 8T$, so distance $= 179{\cdot}2$ m — M1 A1

   (d) $3{\cdot}5 \div (80 - T) = 0{\cdot}0608$ ms^{-2} — M1 A1 — 15