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

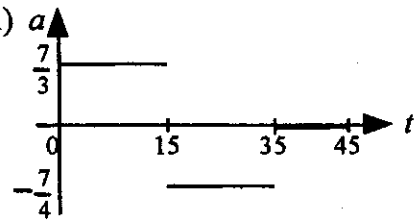
1. (a) $AB^2 = 12{\cdot}25 + 144 = 156{\cdot}25$ $AB = 12{\cdot}5$ m M1 A1
   (b) $12{\cdot}5 \div 5 = 2{\cdot}5$ ms^{-1} (c) $(0{\cdot}7\,\mathbf{i} - 2{\cdot}4\,\mathbf{j})$ ms^{-1} B1 B1; M1 A1 6

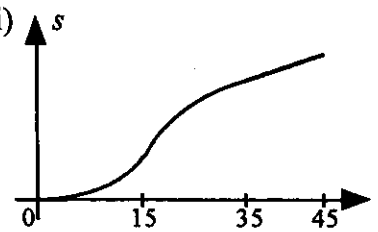
2. (a) $0{\cdot}8g = 2T \sin 30°$ $T = 0{\cdot}8g = 7{\cdot}84$ N B1 M1 A1
   (b) $F = T\cos 30°$, $0{\cdot}8g = T \sin 30°$ $F = 0{\cdot}8g\sqrt{3} = 13{\cdot}6$ N B1 B1 M1 A1 7

3. (a) $s = ut + \frac{1}{2}at^2$: $3u + 4{\cdot}5a = 6$, $9u + 40{\cdot}5a = 39$ M1 A1 A1
   $21 = 27a$ $a = \frac{7}{9}$ ms^{-2} (b) $u = \frac{5}{6}$ ms^{-1} M1 A1; M1 A1 7

4. (a) $F = Ma$, so $F = 3M$ M1 A1
   (b) $F - \mu Mg = 3M$ $F = M(3 + \mu g)$ M1 A1
   (c) $3 + \mu g = \frac{1}{2}g$ $\mu = \frac{1}{2} - \frac{3}{g} = 0{\cdot}194$ M1 A1 A1 7

5. (a) $F = ma$ for each : $2{\cdot}4g - T = 2{\cdot}4a$, $T - 1{\cdot}8g = 1{\cdot}8a$ M1 A1 A1
   Add : $0{\cdot}6g = 4{\cdot}2a$ $a = \frac{1}{7}g = 1{\cdot}4$ ms^{-1} $T = 20{\cdot}2$ N M1 A1 A1
   (b) Now $1{\cdot}8g - T = 1{\cdot}8(0{\cdot}7)$ so $T = 16{\cdot}38$, and $T - mg = m(0{\cdot}7)$ M1 A1 M1 A1
   $10{\cdot}5m = 16{\cdot}38$ $m = 1{\cdot}56$ M1 A1 12

6. (a) (i) $\frac{7}{3}$ ms^{-2}, $-\frac{7}{4}$ ms^{-2}, 0 ms^{-2} B2 (–1 each error)
   (ii) $45 \times 15 + \frac{1}{2} \times 35^2 = 1287{\cdot}5$ m M1 A1
   (b) (i)
   

   (ii)
   

   B2 B2
   (c) $15 \times 9T + 35 \times 3{\cdot}5T = 3708$ $257{\cdot}5T = 3708$ $T = 14{\cdot}4$ M1 A1 M1 A1 12

7. (a) $60 \times 4 = 60u + 90 \times 6u$ $600u = 240$ $u = 0{\cdot}4$ M1 A1 M1 A1
   (b) Change in momentum of $B = 0{\cdot}09 \times 2{\cdot}4 = 0{\cdot}216$ Ns M1 A1 B1
   (c) $60(2) + 90(-8) = 60(-7) + 90v_B$ M1 A1
   $-180 = 90v_B$ $v_B = -2$, so speed = 2 ms^{-1}, direction unchanged M1 A1 A1 12

8. (a) $T_P + T_Q = 22g$ M(A) : $1{\cdot}5(6g) + 3{\cdot}5(8g) = 4{\cdot}5T_Q$ B1 M1 A1
   $T_Q = 37g \div 4{\cdot}5 = 80{\cdot}6$ N $T_P = 22g - T_Q = 135$ N M1 A1 A1
   (b) $2{\cdot}5T_Q = 22g + mg$ M(A) : $mg(2{\cdot}25) + 9g + 28g = 4{\cdot}5T_Q$ B1 M1 A1
   $2{\cdot}25m + 37 = 39{\cdot}6 + 1{\cdot}8m$ $0{\cdot}45m = 2{\cdot}6$ $m = 5{\cdot}78$ M1 A1 A1 12