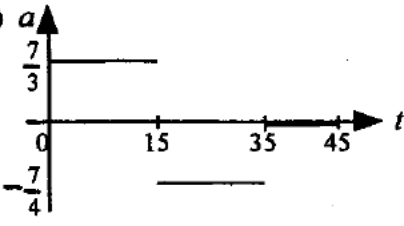
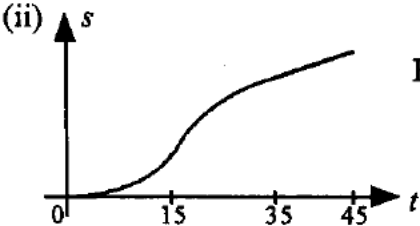


MECHANICS 1 (A) TEST PAPER 1 : ANSWERS AND MARK SCHEME

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) $0 \cdot 8g = 2T \sin 30^\circ$ $T = 0 \cdot 8g = 7 \cdot 84$ N B1 M1 A1
 (b) $F = T \cos 30^\circ$, $0 \cdot 8g = T \sin 30^\circ$ $F = 0 \cdot 8g\sqrt{3} = 13 \cdot 6$ 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⁻² $T = 20 \cdot 2$ 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