

MECHANICS 1 (A) TEST PAPER 2 : ANSWERS AND MARK SCHEME

1. (a) Moments about P : $4g + 8g = 2kg$ $k = 6$ M1 A1 A1
 (b) Resolve vertically: $R = 9g + kg$ $R = 15g = 147 \text{ N}$ M1 A1 5
2. (a) Cos. rule on force Δ : $R^2 = 16 + 36 - 48 \cos 140^\circ$ $R = 9.42 \text{ N}$ M1 A1 M1 A1
 (b) $\sin \theta / 6 = \sin 140^\circ / R$ $\sin \theta = 0.409$ $\theta = 24.2^\circ$ M1 A1 6
3. (a) $7 = \frac{1}{2}gt^2$ $t^2 = 14 \div 9.8$ $t = 1.20 \text{ s}$ M1 A1
 (b) $v = gt = 11.7 \text{ ms}^{-1}$ (c) $0 - 5.8566^2 = -2gh$ $h = 1.75 \text{ m}$ M1 A1; M1 A1 A1
 Modelled stone as particle, ignored air resistance, etc. B1 B1 9
4. (a) P has p.v. $40\mathbf{i} + 80\mathbf{j}$, so $OP = \sqrt{8000} = 89.4 \text{ m}$ B1 M1 A1
 (b) Speed from P to Q is 3 ms^{-1} , so time = 25 s M1 A1
 (c) $OQ = 40\mathbf{i} + 80\mathbf{j} + 25(2.4\mathbf{i} - 1.8\mathbf{j}) = 100\mathbf{i} + 35\mathbf{j}$ M1 A1 A1
 (d) $65(a\mathbf{i} + b\mathbf{j}) = 100\mathbf{i} + 35\mathbf{j}$ $a = \frac{20}{13}$, $b = \frac{7}{13}$ M1 M1 A1 A1 12
5. (a) $10\,000(u_A - 10) = 84\,000$ $u_A = 18.4 \text{ ms}^{-1}$ M1 A1 A1
 $7\,000(u_B + 10) = 84\,000$ $u_B = 2 \text{ ms}^{-1}$ M1 A1 A1
 (b) Resisting force = $\mu R = 0.15 \times 17\,000g = 24\,990 \text{ N}$ M1 A1 A1
 (c) $v = u + at$: $0 = 10 - 0.15gt$ $t = 6.80 \text{ s}$ M1 A1 A1 12
6. (a) $T - 0.2g = 0.4(1)$ $T = 0.4 + 0.2g = 2.36 \text{ N}$ M1 A1 A1
 (b) $Mg - T = 0.4M$ $9.4M = 2.36$ $M = 0.251$ M1 A1 A1
 (c) $0.5 = \frac{1}{2} \times 0.4t^2$ $t = 1.58 \text{ s}$ M1 A1 A1
 (d) P has moved 0.5 m and has speed 0.632 ms^{-1} and acceleration
 $-0.2g$, so $0^2 - 0.632^2 = 2(-0.2g)s$ $s = 0.102$ B1
 Comes to rest $0.75 - (0.5 + 0.102) = 0.148 \text{ m}$ from pulley B1 M1 A1
 M1 A1 15
7. (a) B3
- (b) Time for last section = $240 \div \frac{1}{2}(40) = 12 \text{ s}$, so total time = 72 s M1 A1
 Total distance = $\frac{1}{2}(50 + 72) \times 40 = 2440 \text{ m}$ M1 A1
 Average speed = $2440 \div 72 = 33.9 \text{ ms}^{-1}$ M1 A1
- (c) Put $t = 5$: $k(5m - 25) = 4$ Put $t = 10$: $k(10m - 100) = 0$ B1 B1
 $k = \frac{4}{25}$, $m = 10$ M1 A1 A1
- (d) When $t = 2$, $a = \frac{4}{25} \times 16 = 2.56 \text{ ms}^{-2}$ M1 A1 16