

MECHANICS 2 (A) TEST PAPER 6 : ANSWERS AND MARK SCHEM

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| 1. | (a) $5\,000\,000 \times (15\,000 + 3600) = 2.08 \times 10^7 \text{ Ns or kg m s}^{-1}$
(b) $P = 4000 \times (150 \div 36) = 16.7 \text{ kW}$ | M1 A1 A1
M1 A1 A1 | 6 |
| 2. | (a) $[v - (-u/2)] / (-u - u) = -e \quad v + \frac{1}{2}u = 2ue \quad v = \frac{1}{2}u(4e - 1)$
(b) If $v > 0$ then $4e - 1 > 0$, so $\frac{1}{4} < e \leq 1$ | M1 A1 M1 A1
M1 A1 A1 | 7 |
| 3. | (a) $v = 25 \quad \text{K.E.} = \frac{1}{2} \times 1.8 \times 25^2 = 562.5 \text{ J}$
(b) New K.E. = $\frac{1}{2} \times 1.8 \times 12.5^2 = 140.6 \text{ J}$
Work done = change in K.E. = 422 J | B1 M1 A1
M1 A1 A1
M1 A1 | 8 |
| 4. | (a) P.E. lost = K.E. gained = $19 - \frac{1}{2} \times 0.5 \times 4^2 = 15 \text{ J}$
(b) $0.5gh = 15 \quad h = \frac{30}{g} \quad d = h \div \sin \alpha = \frac{75}{g} = 7.65 \text{ m}$
(c) Modelled block as particle; ignored air resistance | M1 A1 A1
M1 A1 M1 A1
B1 B1 | 9 |
| 5. | (a) Diagram showing weight, tension, two components of reaction or single reaction force at X
(b) $M(X) : 2mg a \cos \theta = mg a \sin \theta \quad \tan \theta = 2 \quad \theta = 63.4^\circ$ | B4
M1 A1 A1 M1 A1 | 9 |
| 6. | (a) (i) $132(11) + 84(3) = 216\bar{x} \quad \bar{x} = 7.89$
(ii) $132(3) + 84(13) = 216\bar{y} \quad \bar{y} = 6.89$
(b) $\tan \alpha = 0.89 \div 1.89 = 0.471 \quad \alpha = 25.2^\circ$ | M1 A1 A1
M1 A1 A1
M1 A1 M1 A1 | 10 |
| 7. | (a) $v = 3t^2 - 14t + 8 = (3t - 2)(t - 4) \quad v = 0 : t = \frac{2}{3}, t = 4$
P is turning round (changing direction)
(b) $s(3) = -12, s(4) = -16, s(5) = -10$, so dist = $4 + 6 = 10 \text{ m}$
(c) $a = 6t - 14 \quad a = -2$ when $t = 2$
Negative acceleration acting on negative velocity, so speeding up | M1 A1 M1 A1
A1
M1 A1 A1
M1 A1
B1 | 11 |
| 8. | (a) $12.5 \text{ ms}^{-1} (7, 24, 25 \Delta)$
(b) $x = 3.5t, y = 12t - \frac{1}{2}gt^2 = 12t - 4.9t^2$,
hence $\mathbf{r} = 3.5t \mathbf{i} + (12t - 4.9t^2) \mathbf{j}$
(c) When $y = 4.4, 4.9t^2 - 12t + 4.4 = 0 \quad t = (12 \pm 7.6)/9.8$
$t = 0.449$ or $t = 2 \quad x = 1.57 \text{ m}, x = 7 \text{ m}$
(d) $\mathbf{v} = 3.5t \mathbf{i} + (12 - 9.8t) \mathbf{j}$ When y-component of \mathbf{v} is 0, $t = 2$
Then $\mathbf{r} = 7\mathbf{i} + 16\mathbf{j}$ | M1 A1
B1 M1 A1
A1
M1 A1
M1 A1 A1
B1 M1 A1
A1 | 15 |