

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

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