

1

a) Looking @ 'A':

$$v = v_{\max}$$

$$u = 0$$

$$a = 1.6 \text{ m/s}^2$$

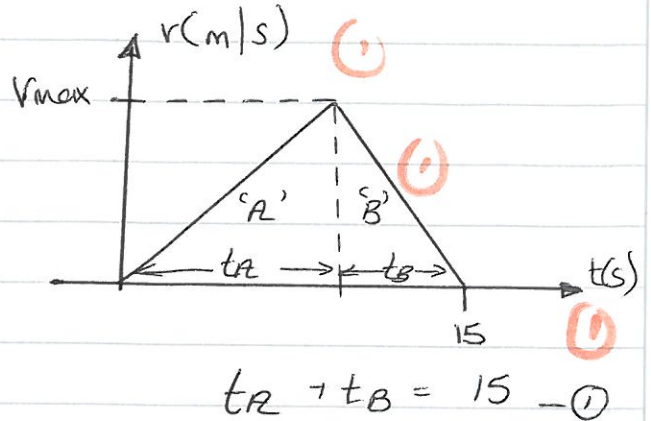
$$t = t_A$$

$$v = u + at$$

$$v_{\max} = 1.6 t_A$$

$$t_A = \frac{v_{\max}}{1.6}$$

$$1.6$$



$$t_A + t_B = 15$$

Looking @ 'B'

$$v = 0$$

$$u = v_{\max}$$

$$a = -3.22$$

$$t = t_B$$

$$v = u + at$$

$$0 = v_{\max} - 3.22 t_B$$

$$3.22 t_B = v_{\max}$$

$$t_B = \frac{v_{\max}}{3.22}$$

$$3.22$$

$$t_A + t_B = 15$$

$$\frac{v_{\max}}{1.6} + \frac{v_{\max}}{3.22} = 15$$

$$v_{\max} \left(\frac{1}{1.6} + \frac{1}{3.22} \right) = 15$$

$$1.17 v_{\max} = 15$$

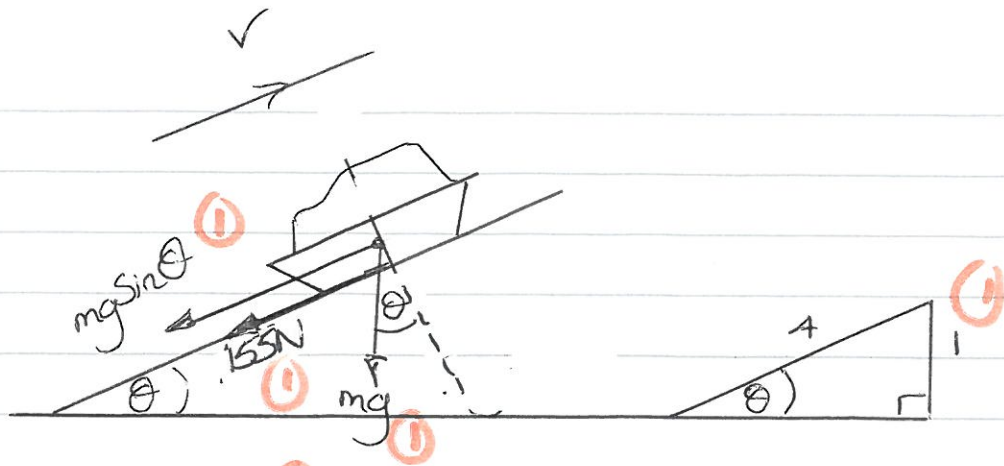
$$v_{\max} = \frac{15}{1.17} = \underline{\underline{12.82 \text{ m/s}}}$$

b) $s = \text{Area of graph}$
 $s = \frac{1}{2} \times \text{base} \times \text{height}$

$$s = \frac{1}{2} \times 15 \times 12.82$$

$$s = \underline{\underline{96.15 \text{ m}}}$$

2.



$$F = mg \sin \theta + 155$$

$$F = (32000 \times 9.81 \times \frac{1}{4}) + 155$$

$$F = 78635 \text{ N}$$

$$\sin \theta = \frac{1}{4}$$

$$\theta = \sin^{-1}\left(\frac{1}{4}\right)$$

$$P = Fv$$

$$v = \frac{P}{F} = \frac{80000}{78635} = \underline{\underline{0.10 \text{ m/s}}}$$

3.

$$T = 4114 \text{ Nm}$$

$$\omega_1 = 0$$

$$\omega_2 = 1600 \text{ rpm} \times \frac{2\pi}{60} = 167.55 \text{ rad/s}$$

$$t = 8 \text{ s}$$

$$\alpha = ?$$

$$\omega_2 = \omega_1 + \alpha t$$

$$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{167.55}{8} = 20.94 \text{ rad/s}^2$$

$$T = I\alpha$$

$$I = \frac{T}{\alpha} = \frac{4114}{20.94} = 196.47 \text{ Kg m}^2$$

b) $k = 600 \text{ mm} = 0.6 \text{ m}$

$$I = mk^2$$

$$m = \frac{I}{k^2} = \frac{196.47}{0.6^2} = 545.75 \text{ kg}$$

c) $P = T\omega = 4114 \times 167.55 = 689300.7 \text{ W}$
 $= 689.30 \text{ kW}$

d) $\omega = 1800 \text{ rpm} \times \frac{2\pi}{60} = 188.50 \text{ rad/s}$

$$P = T\omega$$

$$T = \frac{P}{\omega} = \frac{746500}{188.5} = 3960.21 \text{ Nm}$$

e) $KE = \frac{1}{2} I \omega^2 = \frac{1}{2} \times 196.47 \times 188.5^2 = 3.49 \text{ MJ}$
 $= 3490510.58 \text{ J}$

4. $m = 0.25 \text{ kg}$
 $a_{\text{max}} = 15 \text{ m/s}^2$
 $v_{\text{max}} = 2 \text{ m/s}$

a) $a_{\text{max}} = \omega^2 A$ $v_{\text{max}} = \omega A$

$a_{\text{max}} = \left(\frac{v_{\text{max}}}{A} \right)^2 \cdot A$ $\frac{v_{\text{max}}}{A} = \omega$

$a_{\text{max}} = \frac{v_{\text{max}}^2}{A}$

$a_{\text{max}} = \frac{v_{\text{max}}^2}{A}$

$A = \frac{v_{\text{max}}^2}{a_{\text{max}}} = \frac{2^2}{15} = 0.27 \text{ m}$

$\therefore l = 2 \times A = 2 \times 0.27 = \underline{0.53 \text{ m}}$

b) $F_{\text{max}} = m \omega^2 A$ $\omega = \frac{v_{\text{max}}}{A}$

$F_{\text{max}} = 0.25 \times 7.41^2 \times 0.27$

$F_{\text{max}} = \underline{3.71 \text{ N}}$ $\omega = \frac{2}{0.27} = 7.41 \text{ rad/s}$

c) $n = \frac{\omega}{2\pi} = \frac{7.41}{2\pi} = \underline{1.18 \text{ Hz}}$

d) $T = \frac{1}{n} = \frac{1}{1.18} = \underline{0.85 \text{ s}}$