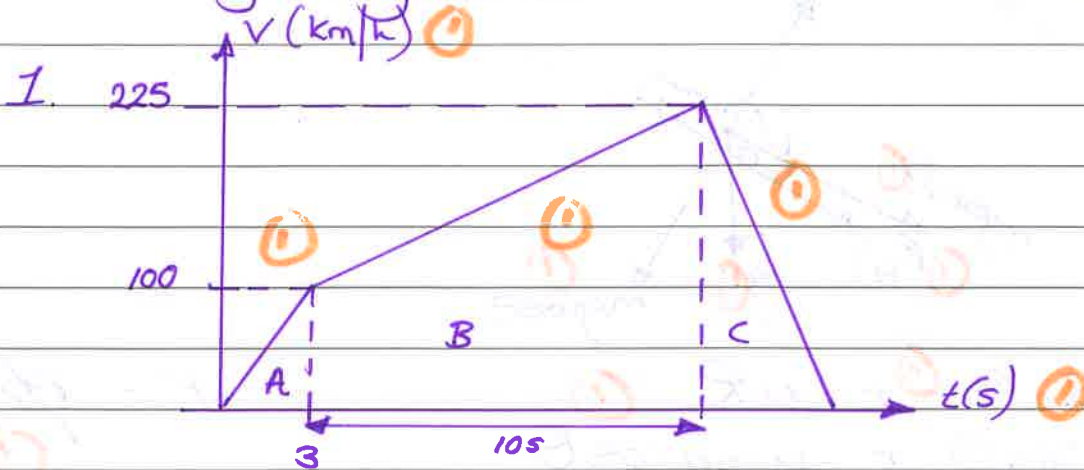


Engineering Science M4X02192 2018-2019



a) $u = 0$

$v = u + at$

$v = 100 \times \frac{1000}{3600} = 27.78 \text{ m/s}$

$t = 3 \text{ s}$

$a = ?$

$a = \frac{v - u}{t}$

$a = \frac{27.78}{3} = 9.26 \text{ m/s}^2$

b) $u = 27.78 \text{ m/s}$

$v = 225 \times \frac{1000}{3600} = 62.5 \text{ m/s}$

$t = 10 \text{ s}$

$a = ?$

$a = \frac{v - u}{t}$

$a = \frac{62.5 - 27.78}{10} = 3.47 \text{ m/s}^2$

c) $u = 62.5 \text{ m/s}$

$v = 0$

$t = ?$

$s = 65 \text{ m}$

$s = \frac{(u + v)t}{2}$

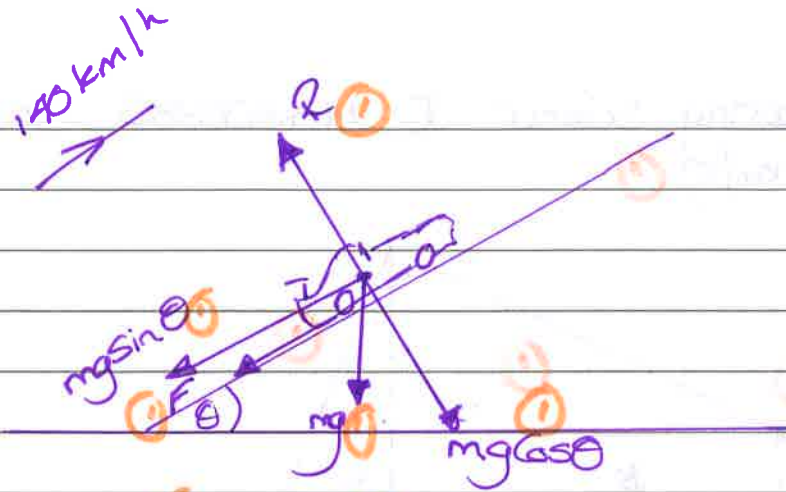
$t = \frac{2s}{(u + v)} = \frac{2 \times 65}{62.5} = 2.08 \text{ s}$

d) $s = \frac{1}{2} \text{ base} \times \text{height} = \frac{1}{2} \times 3 \times 27.78 = 41.67 \text{ m}$

$s = \frac{(a + b)t}{2} = \frac{(27.78 + 62.5)10}{2} = 451.4 \text{ m}$

$\therefore 41.67 + 451.4 + 65 = 558.07 \text{ m}$

2.



$$F = mg \sin \theta + \mu R$$

$$F = mg \sin \theta + \mu mg \cos \theta$$

$$F = (888 \times 9.81 \times \sin 20) + (\mu \times 888 \times 9.81 \times \cos 20)$$

$$\frac{P}{v} = (888 \times 9.81 \times \sin 20) + (\mu \times 888 \times 9.81 \times \cos 20)$$

$$\mu = \frac{P - (888 \times 9.81 \times \sin 20)}{(888 \times 9.81 \times \cos 20)}$$

$$\mu = \left[\frac{\left(\frac{150000}{38.89} \right) - (888 \times 9.81 \times \sin 20)}{(888 \times 9.81 \times \cos 20)} \right]$$

$$\mu = 0.14$$

3. $\omega_1 = 0$

a) $\omega_2 = 20000 \text{ rpm} \times \frac{2\pi}{60}$
 $= 2094.40 \text{ rad/s}$

$t = 0.5 \text{ s}$

$\alpha = ?$

$\omega_2 = \omega_1 + \alpha t$

$\alpha = \frac{\omega_2 - \omega_1}{t}$

$\alpha = \frac{2094.4}{0.5} = 4188.79 \text{ rad/s}^2$

$T = I\alpha$

$I = \frac{T}{\alpha} = \frac{145}{4188.79} = 0.035 \text{ kg m}^2$

b) $I = mk^2$

$I = m \frac{d^2}{8} \therefore m = \frac{I}{d^2/8} = \frac{0.035}{(0.26^2/8)} = 4.14 \text{ kg}$

c) $P = T\omega = 145 \times 2094.40 = 303688 \text{ W}$
 $= 303.69 \text{ kW}$

d) $KE = \frac{1}{2} I \omega^2 = \frac{1}{2} \times 0.035 \times 2094.4^2 = 76.76 \text{ kJ}$

1.

$n = 0.65 \text{ Hz}$

$A = 1.75 \text{ m}$

a) $n = \frac{\omega}{2\pi} \quad \omega = 2\pi n = 2\pi \times 0.65 = 4.08 \text{ rad/s}$

b) $T = \frac{2\pi}{n} = \frac{2\pi}{0.65} = 9.67 \text{ seconds}$

$F_{\max} = m\omega^2 A$

$m = \frac{F}{\omega^2 A} = \frac{10000}{4.08^2 \times 9.67} = 253.46 \text{ kg}$

