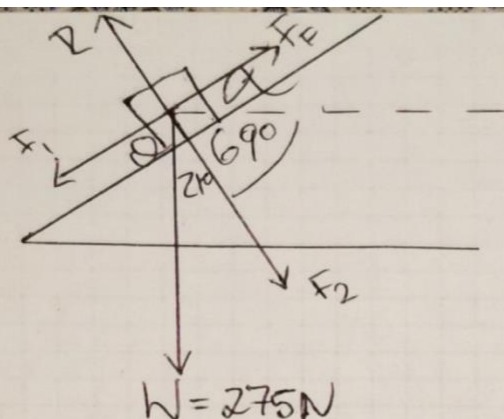


a) i)



Balanced

$$F_i = F_f$$

$$\theta = 69^\circ$$

$$F_i = 275 \cos 69 = 98.55 \text{ N}$$

$$F_f = 98.55 \text{ N}$$

ii) $\alpha = 90^\circ - 69^\circ = 21^\circ$

iii) $R = F_2$ balanced

$$F_2 = 275 \cos 21 = 256.73 \text{ N}$$

$$R = 256.73 \text{ N}$$

b) ii) Momentum = $\frac{\text{kgm}}{\text{s}}$ i) $p = mv$

c) i) $275 \text{ N} = 28 \text{ kg}$ $g = 9.81 \text{ ms}^{-2}$

$$F = ma$$

$$F = 28 \times 2.5$$

$$F = 70 \text{ N}$$

ii) $p = mv$

$$p_1 = 28 \times 0$$

$$p_1 = 0 \frac{\text{kgm}}{\text{s}}$$

$$p_2 = 28 \times 7.5$$

$$p_2 = 210 \frac{\text{kgm}}{\text{s}}$$

Change in momentum would be $210 \frac{\text{kgm}}{\text{s}}$.

iii) $a = \frac{(v_1 - v_0)}{t}$

$$v_1 = 12.5 \text{ ms}^{-1} \quad v_0 = 0 \text{ ms}^{-1}$$

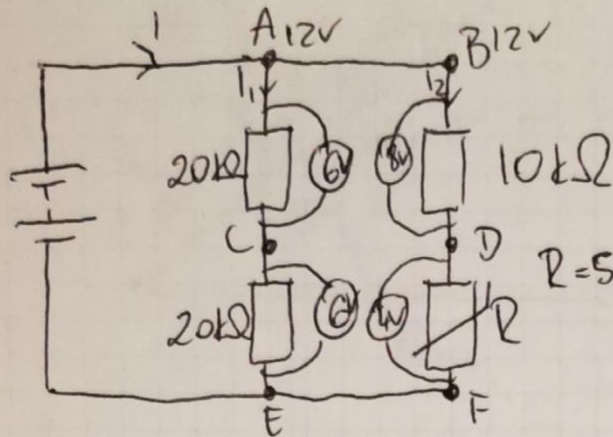
$$a = \frac{12.5 \text{ ms}^{-1}}{3.2 \text{ s}}$$

$$a = 3.91 \text{ ms}^{-2}$$

$$F = ma$$

$$F = 5 \times 3.91$$

$$F = 19.55 \text{ N}$$



$$i) R_1 = 20k\Omega + 20k\Omega = 40k\Omega$$

$$R_2 = 10k\Omega + 5k\Omega = 15k\Omega$$

$$\frac{1}{R_T} = \frac{1}{40} + \frac{1}{15}$$

$$\frac{1}{R_T} = 0.09$$

$$R_T = 11k\Omega$$

$$ii) I = \frac{V}{R}$$

$$I = \frac{12}{11} = 1.1 \text{ mA}$$

$$iii) P = IV$$

$$I_1 = \frac{12}{40} = 0.3 \text{ mA} \quad I_2 = 1.1 - 0.3 = 0.8 \text{ mA}$$

$$P_{20k\Omega} = (0.3)(6) = 1.8 \text{ mW}$$

$$V_{10k\Omega} = (0.8)(10) = 8 \text{ V}$$

$$V_{5k\Omega} = 12 - 8 = 4 \text{ V}$$

$$P_{10k\Omega} = (0.8)(8) = 6.4 \text{ mW}$$

$$P_{5k\Omega} = (0.8)(4) = 3.2 \text{ mW}$$

$$b) i) PD \text{ A-C} = 12 - 6 = 6 \text{ V}$$

$$ii) PD \text{ D-F} = 4 \text{ V}$$

$$iii) PD \text{ C-D} = 6 - 4 = 2 \text{ V}$$

a) Moment is a force multiplied by perpendicular distance to the axis of rotation

b) i)

$$x = 250 \text{ N}$$

$$M = Fd$$

$$M = (250)(48)(10^{-3})$$

$$M = 12 \text{ Nm}$$

ii) Equilibrium

$$M = Fd$$

$$12 = F(27)(10^{-3})$$

$$F = \frac{12}{27 \times 10^{-3}} = \frac{12}{0.027}$$

$$F = 444.44 \text{ N}$$

iii) $F = kx$ x - spring extension

iv)

$$k = \frac{F}{x}$$

$$k = \frac{444.44}{0.015} = 29.6 \text{ kNm}^{-1}$$

v)

$$W = \frac{1}{2} Fx$$

$$W = \frac{1}{2} (444.44)(15)(10^{-3})$$

$$W = 3.33 \text{ J}$$

$$c) i) \text{ Power} = \frac{\text{Energy}}{\text{Time}} = \frac{\text{J}}{\text{s}} = \text{W}$$

$$ii) P = \frac{3.33}{2.2} = 1.51 \text{ W}$$

$$d) P = \frac{3200}{2.2} = 1454.5 \text{ W}$$

$$\frac{1454.5}{1.51} = 963$$

Trigger will be squeezed 963 times.