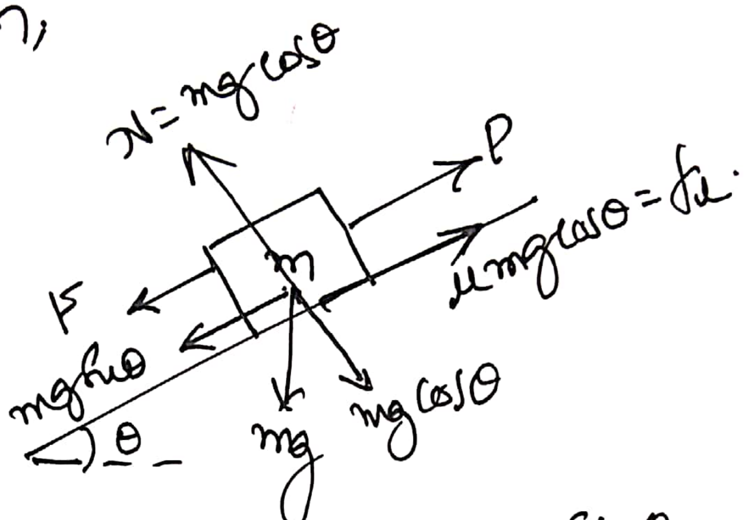
(1) For the block not to move in downwards direction,



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

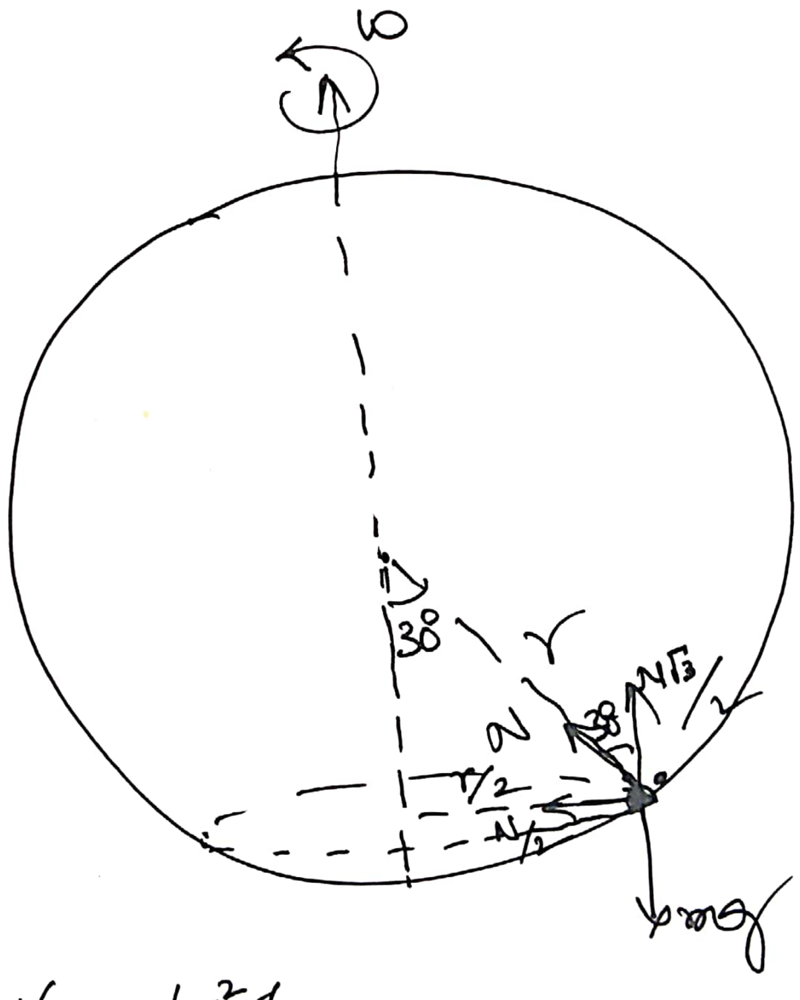
(2)

$mg\sin\theta + 2 = \mu mg\cos\theta \Rightarrow mg(\sin\theta - \mu\cos\theta) = -2$

$mg\sin\theta + \mu mg\cos\theta = 10 \Rightarrow mg(\sin\theta + \mu\cos\theta) = 10$

solving $\mu = \sqrt{3}/2$

(3)



$\frac{N}{2} = m\omega^2 \frac{r}{2}$

$\frac{N\sqrt{3}}{2} = mg$

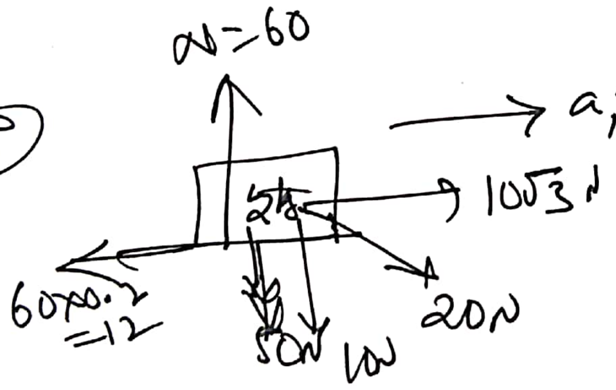
$\Rightarrow \omega^2 = \frac{2g}{r\sqrt{3}}$

④ $F = kt$

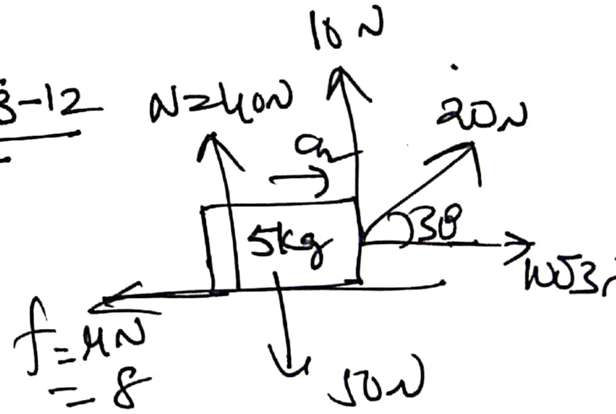
$\frac{dP}{dt} = kt \Rightarrow \int_{P}^{3P} dP = k\int_{0}^{T} t\,dt$

$2P = \frac{kT^2}{2} \Rightarrow T = 2\sqrt{\frac{P}{k}}$

⑤



$\longrightarrow a_1 = \frac{10\sqrt{3}-12}{5}$



$a_2 = \frac{10\sqrt{3}-8}{5}$

$\therefore a_2 - a_1 = \frac{12-8}{5} = 4/5 = 0.8\ m/s^2$

(6) Let Area of (.5) of mesh which stops liquid is A_1.

∴ momentum destroyed per unit time (or) force exerted by liquid on that part is

$$= \rho A_1 v^2$$

Let Area of (.5) of mesh which sends liquid balls is A_2

∴ Momentum destroyed per unit time (or) force exerted by liquid on that part is

$$= \rho A_2 v^2 \times 2$$

$$\therefore \text{Force exerted} = \rho v^2 (A_1 + 2A_2)$$

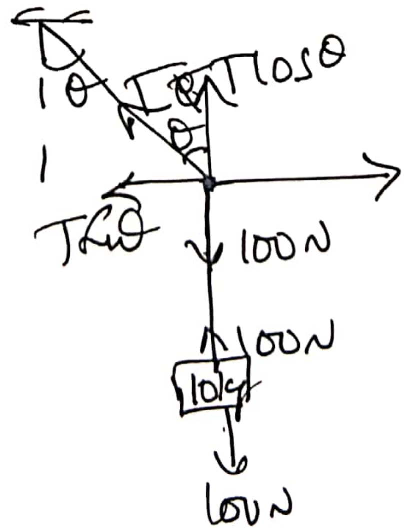
$$\therefore \text{pressure on mesh} = \frac{\rho v^2 (A_1 + 2A_2)}{A_1 + A_2}$$

But $A_1 = A_2$ [as given problem both 25% each]

$$\therefore P_{av} = \rho v^2 \times \frac{3}{2}$$

$$= \frac{3}{2} \rho v^2$$

(7)



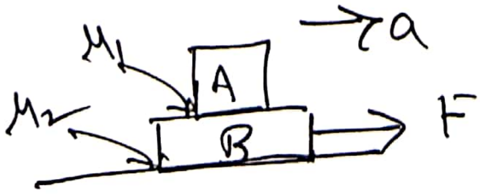
$$T \sin\theta = F$$

$$T \cos\theta = 100$$

$$100 \tan\theta = F$$

$$\therefore F = 100N$$

(8)

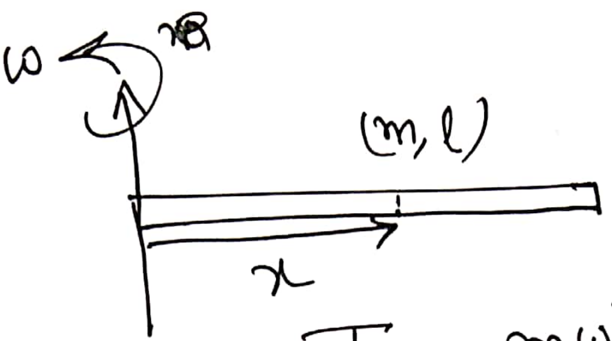


a_{max} so that 'A' does not slide on B $= \mu_1 \times g$.

$$\therefore F_{max} = \mu_2 (m_A + m_B) g + (m_A + m_B) g$$

Scanned with CamScan

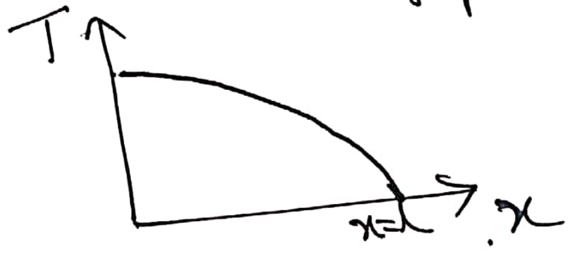
(9)



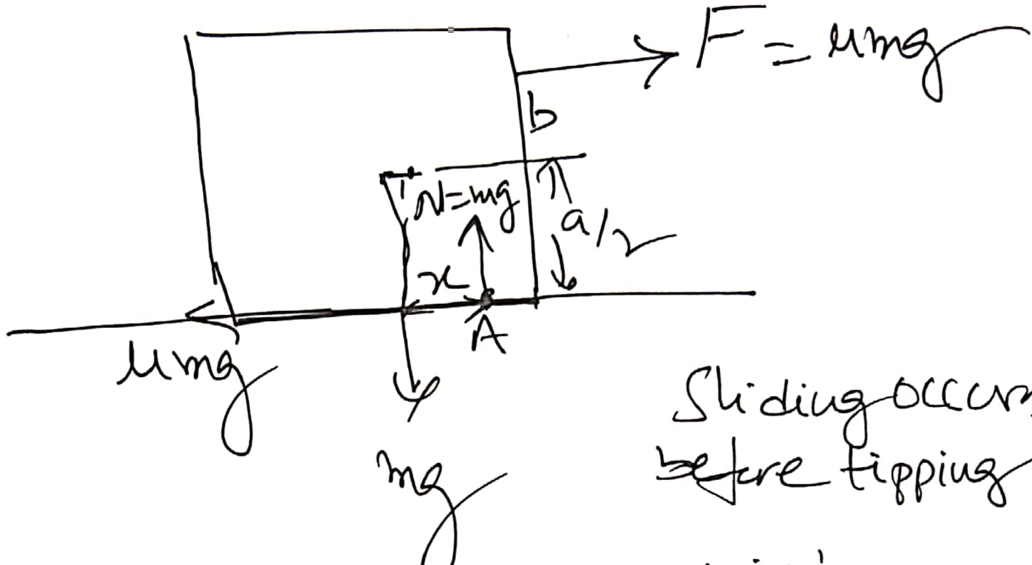
$$T_{(x)} = \frac{m\omega^2}{2l}\left(l^2 - x^2\right).$$

$$\frac{dT}{dx} = -\frac{m\omega^2}{l}x$$

∴ Slope is −ve and |slope| inc with x.



(10)



Sliding occurs before tipping.

Taking moments about 'A'

$$mgx = \mu mg\left(\frac{a}{2}+b\right)$$

$$\frac{x}{\mu} = \frac{a}{2}+b$$

$$b = \frac{x}{\mu} - \frac{a}{2} \Rightarrow b_{Max} = \frac{a}{2\mu} - \frac{a}{2}$$

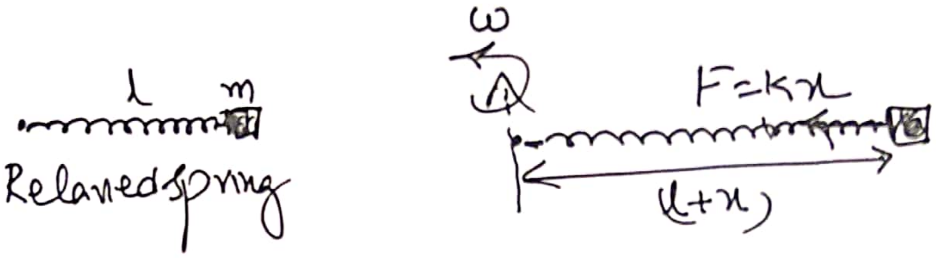
$100\left(\frac{b}{a}\right)_{Max}$ occurs at $b_{Max} = \frac{a}{2}\left(\frac{1}{0.4} - 1\right)$

$$= \frac{a}{2} \times \frac{0.6}{0.4}$$

$$\therefore \left(\frac{100 \times b}{a}\right)_{Max} = 100 \times \frac{a \times 0.6}{2 \times a \times 0.4}$$

$$= 75$$

(11)



$$F = kx = m\omega^2(l+x) \Rightarrow x = \frac{m\omega^2 l}{k - m\omega^2}$$

(12) Similar to 7

(13)