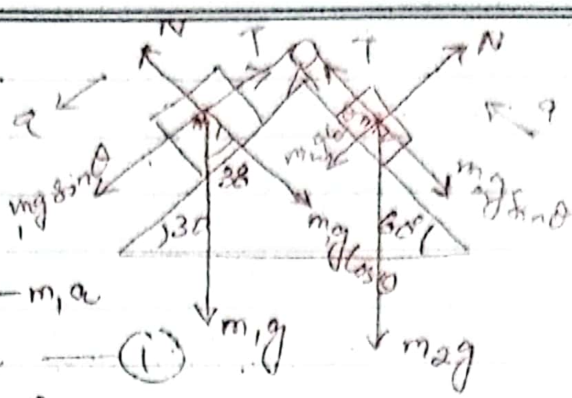
Rough Work

Q.1 (a)



m_1

$\Sigma F_x = -m_1 g \sin\theta + T = -m_1 a$

$-T + m_1 g \sin\theta = m_1 a$ —— (1)

$\Sigma F_y = N - m_1 g \cos\theta = 0$

m_2

$\Sigma F_x = m_2 g \sin\theta - T = -m_2 a$

$T = m_2 g \sin 60^\circ + m_2 a$ —— (2)

$\Sigma F_y = N - m_2 g \cos 60 = 0$

using (1) & (2)

$T = m_1 g \sin 30 - m_1 a = m_2 g \sin 60^\circ + m_2 a$

$m_1 g \sin 30 - m_2 g \sin 60 = m_2 a + m_1 a$

$\dfrac{m_1 g \sin 30 - m_2 g \sin 60}{m_1 + m_2} = a$

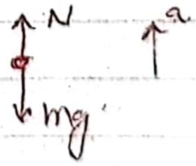
$\dfrac{3(9.8)\sin 30 - 2(9.8)\sin 60}{3+2} = \dfrac{14.7 - 16.97}{5} = -0.45\, m/s$

$\boxed{a = -0.45\, m/s}$

eq (2) ⇒ $T = (2)(9.8)\sin 60^\circ + (2)(0.45)$

$= 16.97 + 0.909 = \boxed{16\, N = T}$

(b) (i) $N - mg = ma$



(ii) Increase.

(c) B/c they depend on normal force and for Static friction, the applied force, despite having fixed Coefficients.

Q.2

(a) $m = 0.12\,kg$
$x_m = 8.5\,cm = 0.085\,m$
$T = 0.2\,sec$
$F = ?$ $k = ?$

$$F = ma = m x_m \omega^2 = m x_m \left[\frac{2\pi}{T}\right]^2$$
$$= (0.12)(0.085)\left[(2\pi)/0.2\right]^2$$

$$\boxed{F = 10.082\,N}$$

$$F = -kx \Rightarrow k = \frac{F}{x} = \frac{10.082}{0.085} =$$

$$\boxed{k = 118.1764\,N/m}$$

(b) If we analyze the projection of the motion along one axis, as this projection oscillates sinusoidally with time.

(c) $KE_{max} = \frac{1}{2} k x_m^2$ $K_{max} = 6J$ $K_s = 4J$
$x_m = 12\,cm = 0.12\,m$

$$k = \frac{2\,KE_{max}}{x_m^2}$$
$$= \frac{2(6)}{(0.12)^2}$$

$$\boxed{k = 833\,N/m}$$

Rough Work

3 (a) (1) $k=1 \quad \omega=3$

$v = \frac{\omega}{k} = \frac{3}{1} = 3$

(3) $k=4 \quad \omega=1$

$v = \frac{1}{4} = 0.25$

(2) $k=2 \quad \omega=1$

$v = \frac{1}{2} = 0.5$

(4) $k=1 \quad \omega=2$

$v = \frac{\omega}{k} = \frac{2}{1} = 2$

Rank $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

(b) $y(x,t) = y_m \sin(kx - \omega t + \phi)$

$u = -y_m \omega \cos(kx - \omega t + \phi)$

$u_s = 0.4m \Rightarrow y_m \omega = 0.5m$ at $x=0$, $t=0$

$0.4 = -(0.5)\cos(0+0+\phi)$

$\frac{0.4}{0.5} = \cos\phi =$

$\phi = \cos^{-1}(0.8)$

$= \cancel{36.8}$

$\boxed{\phi = 0.643}$ rad

(c) $y_m' = 1.5 y_m$

$y_m' = 2y_m \cos\frac{\phi}{2}$

$1.5 \cancel{y_m} = 2\cancel{y_m} \cos\frac{\phi}{2}$

$0.75 = \cos\frac{\phi}{2} \Rightarrow \frac{\phi}{2} = \cos^{-1}(0.75)$

$\boxed{\phi = 1.44 \text{ rad}}$

$\phi = \frac{1.44}{2\pi} = 0.23$ (in wave length)

$\boxed{\phi = 0.23\lambda}$