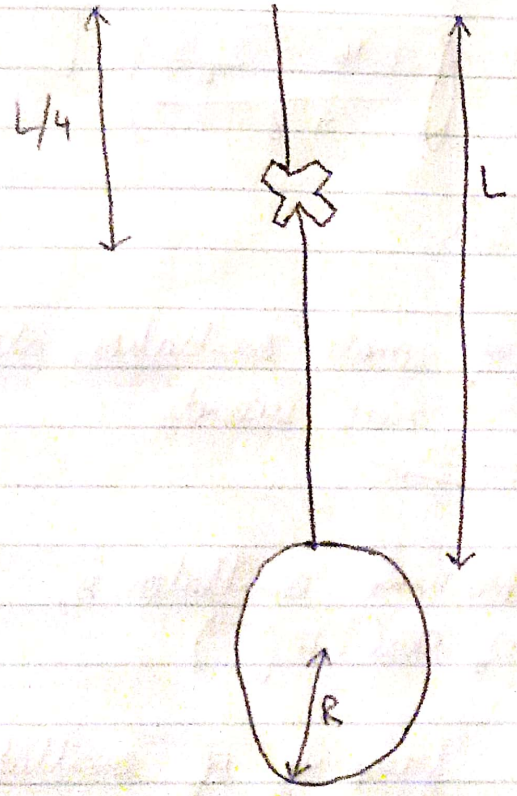
NAME :- SHREYAS SRINIVASA

05/11/2021

PHYS-250

LAB QUIZ #12

The diagram below represents a thin rod of length L and mass m is attached to a solid disc of radius $R = \frac{L}{3}$, and three times as massive as the rod (that is, its mass is 3m). The whole system is suspended from a frictionless pivot point located at $\frac{L}{4}$ from the top of the rod (as indicated by the cross for the diagram). The parameter values are also shown below.



m = 3.27 kg
L = 3.16 m

(a) Determine the period of the small oscillations about the pivot point

(b) If the amplitude of the oscillations is $\theta_0 = 0.12$ rad, write the equation for this harmonic oscillator.

(c) If the system is oscillating for 15 seconds, determine how many oscillations it has done.

P.T.O

Ans. Given:- Mass of rod, $m = 3.7$ kg
Length of rod, $L = 3.16$ m
Mass of disk, $M = 3$ m
Radius of disk, $R = \frac{L}{3}$

(a) Period of oscillation about pivot point is,

$$T = 2\pi \left(\sqrt{\frac{L - \frac{L}{4}}{g}} \right)$$

$$\Rightarrow T = 2\pi \left(\sqrt{\frac{3.16 - \frac{3.16}{4}}{9.8}} \right) \quad [\because g = 9.8 \text{ m/s}^2]$$

$$\therefore T = 3.085$$

$\therefore$ Period of small oscillations about the pivot point = 3.08 seconds

(b) Equation for harmonic oscillator is,

$$x(T) = \theta_0 \cos(2\pi f T)$$

Here, f is the frequency of oscillation.

(c) If the system is oscillating for $T_1 = 15$ s,

then number of oscillation is given as:-

$$f = \frac{n}{T_1}$$

Here, n is the number of oscillations & f is the frequency of oscillation.

P.T.O

The value of f is,

$$f = \frac{1}{T}$$

$$f = \frac{1}{3.08}$$

$$f = 0.32\ Hz$$

$$\therefore\ 0.32 = \frac{n}{15}$$

$$\therefore\ n \approx 5$$

$\therefore$ The number of oscillations is 5.