Name Federico Tatar Date 11/04/2023

CRN 88842 GTA Name Merritt

Lab 10: Rotational Motion

PHYS 2305

Pre-lab Assignment

Question Pre-1: What is the moment of inertia of the ring in Figure 10. 1 with total mass M, inner radius R_1, and outer radius R_2 rotating about the axis shown?

$$I = \frac{1}{2} M \left(R_1^2 + R_2^2 \right)$$

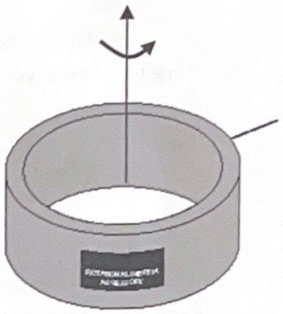

Figure 10. 1

Question Pre-2: The disk in Figure 10. 2 has total mass M and radius R and is initially at rest. You apply a net torque $\Sigma\vec{\tau}$ to it, which causes the disk to start rotating about the axis shown. What is the angular acceleration of the disk?

Since $I = \left(\frac{1}{2} m R^2\right) \alpha$

$$\alpha = \frac{2T}{MR^2}$$

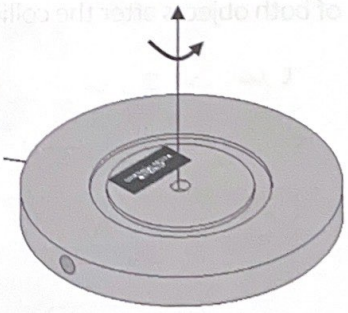

Figure 10. 2

Question Pre-3: Refer to Section 1.1. In Figure 10. 3, everything is initially at rest. The hanging mass has a mass M and the rotational platform has a moment of inertia I. The hanging mass is then released, causing the platform to rotate. After some time, the mass has fallen through a distance h. At this time, the hanging mass is falling with speed v, and the platform has an angular speed ω.
In terms of the quantities given in this problem, write an expression that relates the total kinetic energy of the **rotating platform + falling mass** to the gravitational potential energy of the mass.

$KE = \frac{1}{2}mv^2$

Rotational KE $= \frac{1}{2}I\omega^2$

$GPE = Mgh$

Hanging Mass $= \frac{1}{2}mv^2$

Conservation of Energy: ...

$Mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$

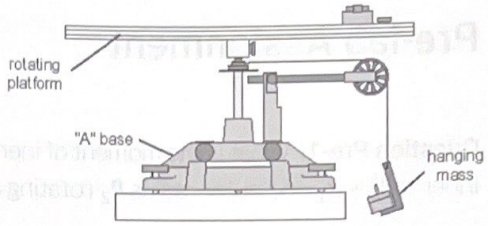

Figure 10. 3

Question Pre-4: An object with a moment of inertia I_1 is rotating at a constant angular velocity $\vec{\omega}_1$. Another second object with a moment of inertia I_2 is dropped from rest on the first object, and then both objects rotate together. What is the angular velocity of both objects after the collision?

$I_1\omega_1 = I_2\omega_2$

$I_1\vec{\omega}_1 = (I_1 + I_2)\vec{\omega}_2$

$$\vec{\omega}_2 = \frac{I_1}{I_1 + I_2}(\vec{\omega}_1)$$