Moment of Inertia Hand in Sheet

Name________________________________

Partner______________________________

length of metal rod: l = .38 m
Radius of the pulley: r = 1.8 cm
mass of metal rod: m_{rod} = **.0256kg**

1. Show how Torque can be found by the equation $\tau = m_h r(g - \alpha r)$

2. Linearize the Equation $\tau = I\alpha$. Explain how the moment of inertia can be found experimentally from Graphing τ vs α will give a slope that represents the moment of inertia of the rotating object with the correct units.

Experiment 1. The rod alone:

3. Using your graph, determine the experimental moment of Inertia of the rod alone.

$I_{rod\ exp}$=

Experiment 2. The rod and the orbiting masses about 20 cm apart:

4. Using your graph, determine the **experimental** moment of Inertia of the rod + 2 orbiting masses 20 cm apart.

$I_{rod+2mo}$ =

5. The moment of inertia is additive. Use the result of Experiment 1 and 2 to determine the **experimental** moment of inertia of the to 2 orbiting masses alone, I_{2mo}:

$I_{rod+2mo} = I_{rod} + I_{2mo}$

I_{2mo} exp =

6. Find the **theoretical** moment of inertia of the 2 masses combined using the formula **I = mR²** for *each* of the orbiting masses.

I_{2mo} theo =

7. Find the percent difference using $\% = \frac{|Itheo - I\ exp|}{Itheo} \times 100$

<u>Experiment 3.</u> The rod and the orbiting masses at the end of the rod:

8. Using your graph, determine the **experimental** moment of Inertia of the rod + 2 orbiting masses.

9. Moment of inertia is additive. Use the result of Experiment 1 and 2 to determine the **experimental** moment of inertia of the to 2 orbiting masses alone, I_{2mo}.

$I_{rod+2mo} = I_{rod} + I_{2mo}$

I_{2mo} exp =

10. Find the **theoretical** moment of inertia of the 2 masses combined using the formula **I = mR²** for *each* of the orbiting masses.

$I_{2mo\ theo}$ =

11. Find the percent difference using $\% = \frac{|Itheo - I\,exp|}{Itheo}$x 100

12. Using the formula : $Irod = \frac{1}{12}ml^2$, that the length of the rod= .38 m and the mass of rod = .0256 kg, determine the **theoretical** moment of inertia of the rod alone.

$I_{rod\ theo}$=

13. The theoretical moment of inertia of the rod alone is less than the experimental moment of inertia from experiment 1. This is because the pulley and the metal axle also have a moment of inertia which we didn't account for in our experiment.

So $I_{rod\ exp} = I_{rod\ +\ pulley/axle}$. Use the additive property of moment of inertia and the results from experiment 1 and question 12 to find the moment of inertia of the pulley and metal axle.

$I_{rod\ +\ pulley/axle} = I_{rod\ theo} + I_{pulley/axle}$

$I_{pulley/axle}$ =

Mass of Orbiter, Mo = __________

Exp 2 Radius of orbiter, R = ______

Exp 3 Radius of orbiter, R = ________

Raw Data

Experiment 1

hanging mass, Mh, kg	angular acceleration, α, rad/s²	Torque, τ, mN

Experiment 2

hanging mass, Mh, kg	angular acceleration, α, rad/s²	Torque, τ, mN

Experiment 3

hanging mass, Mh, kg	angular acceleration, α, rad/s²	Torque, τ, mN