PVC Pipe Rotational Dynamics Lab Worksheet Name:

Materials: PVC pipe set up, hanging mass of 100 to 200 grams, stopwatch, string, pulley with clamp, box, metal stand, meter stick

Steps

1. Calculate the moment of inertia for the PVC pipe setup by summing
   Use the following approximation equations:
   Moment of Inertia for vertical PVC pipe shaft: 1*mass*radius^2
   *Include the T joint in the vertical PVC pipe shaft mass.
   Moment of Inertia for each horizontal PVC pipe shaft: (1/3)*mass*length^2
   Moment of Inertia for each PVC pipe elbow joint: mass*radius^2

   PVC Vertical Shaft (with T joint): I = _____ kg*m^2

   Individual PVC Horizontal Shaft: I = _____ kg*m^2 x2 total I = _____ kg*m^2

   Individual PVC elbow joint : I = _____ kg*m^2 x2 total I = _____ kg*m^2

   Predicted Moment of Inertial for the PVC pipe setup: _____ kg*m^2

2. Draw a force diagram for the hanging mass as it falls and the PVC setup rotates.
   Include tension and force gravity.

3. Write the net force literal equation for the hanging mass. Include tension (T), net force (m*a) and force gravity (m*g). Solve for tension (T).

4. What is the relationship between the torque on the vertical shaft and the tension in the string along with the radius of the vertical PVC pipe?

5. What is the relationship between the linear acceleration of the hanging mass and the angular acceleration of the PVC set up?

Use a stopwatch OR....

6. Take video of your apparatus as it begins from rest and increases in angular velocity. Include the hanging mass in the video as it accelerates to the ground. Repeat multiple times with different hanging masses. Keep the drop height constant. Report your data in the table below:

Method	Measure	Measure	Measure	a=2*d/t^2	T=mg-ma	alpha = a/r	T*radius	I = Torque/alpha
Unit	Kg	Seconds	Meters	m/s/s	Newtons	rad/sec/sec	N*m	kg*m^2
Variable	**Falling Item Mass**	**Time to Fall**	**Distance Fallen**	**Linear Acceleration**	**Tension**	**Angular Acceleration**	**Torque**	**Observed I**
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

7. Create a scatterplot of observed torque (y-axis) and observed angular acceleration (x-axis) for the different masses. Draw a linear best fit line through the points. What is the slope of the line?

8. What is significance of the slope calculated in the previous problem?

9. Find the percent difference in the observed I and the predicted I of the PVC set up.

% difference = ((predicted - observed)/(observed))*100