Lab 6-2: **Centripetal Force**

Purpose: Whenever an object moves in a circle with constant speed and radius, the net force on the object is always directed to the *center* of the circle. The net force in this situation is given the special name, *centripetal force*, which simply means "center-seeking" force.

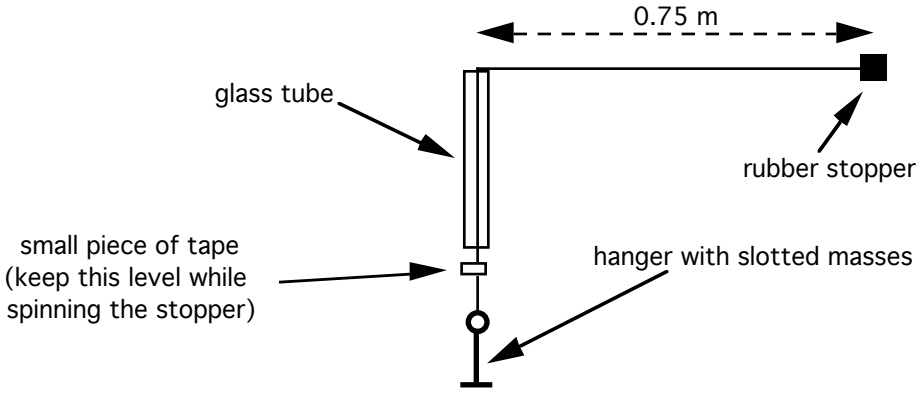
Centripetal forces depend on an object's mass, speed, and radius of the circular path. In this lab, you will determine how centripetal forces depend on the speed of an object.

Materials:

1 hanger	1 glass tube	1 rubber stopper
1 string (~1 m)	small piece of tape	1 stop watch
slotted masses (total of 200 grams)		

Procedure:

1. Find the mass of the rubber stopper, record it in the data table, and then set up your apparatus as shown in the diagram below.



2. Adjust the length of the string so that there is 0.75m from the glass tube to the middle of the stopper. Attach a small piece of tape to the string a few centimeters below the bottom of the glass tube. (*This will give you a reference point to keep the radius constant at 0.75 m while spinning the stopper.*)
3. Without any additional masses on the hanger, practice spinning the stopper. You need to be able to spin the stopper in a horizontal circle over your head and keep the piece of tape at the same distance below the glass tube. **Be careful not to hit any passersby while you are spinning the stopper!**
4. Without any additional masses on the hanger, spin the stopper. When you are ready, time how long it takes for the stopper to make 30 revolutions. (*This is easier if someone counts and someone else uses the stop watch.*) Record your results.
5. Add 50 grams to the hanger, and repeat step #5. Do this four times, each time adding an additional 50 grams.

Data:

Mass of rubber stopper = _____ kg

Radius of circular path = 0.75 m

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Note: While doing the lab, the only data you need to take is the third column of the data table (Time for 30 revolutions). The rest of the table is calculated.

Mass hanging (kg)	Weight hanging F_c (N)	Time for 30 revolutions (s)	Period of 1 revolution (s)	Circumference of circle (m)	Speed of stopper (m/s)
.050					
.100					
.150					
.200					
.250					

Graph: Complete the rest of the data table by doing the appropriate calculations. Make a graph of Centripetal Force vs. Speed. Make sure you can see the origin. This will NOT be a straight line. Linearize your data to find the relationship between force and speed. Make sure to include labels, units. titles and regression line. Include the linearized graph with this lab.

Conclusion:

1. What is the equation that relates centripetal force and speed for your experimental setup?

2. Simplify the units of the slope of your equation.

3. What is the physical significance of the slope of this equation?

4. What is the general equation that relates Centripetal Force and Speed?

5. The rubber stopper did not actually travel in a horizontal circle. We should have measured the angle at which the stopper dipped below horizontal. Draw and label a correct force diagram for the rubber stopper. In addition, write out Newton's Second Law for the stopper for both components.

6. Since the analysis you did on your data ignored the dipping of the stopper, why did it work so well? (At least, it should have worked.)