Lab – Centripetal Force **Mr. Cote'**

Introduction

An object moving in a circle (your car going around a corner, for example) experiences acceleration. Even if the *linear speed* of the object remains constant, the direction of velocity is changing, and therefore, there must be an *acceleration*. Furthermore, if there is acceleration, Newton's 2nd Law says that there must be an unbalanced force in the direction of the acceleration. For circular motion, we refer to these things as **centripetal force** and **centripetal acceleration**.

General Objective

The objective of this lab is to determine the functional relationship between **centripetal force, angular velocity, tangential velocity, mass,** and **radius** for objects in circular motion. You will use the relationships you discover in this lab to answer questions about things like planetary orbits and other satellite motion.

Setup

Each group will use the setup shown in figure 1 below. I will instruct you in the proper use of this equipment. You will increase the amount of centripetal force applied to the rubber stopper by adding washers to the bottom end of the string. For all trials, you will swing the stopper in a horizontal circle over your head, trying to maintain constant circular motion, and will record values for the desired variables, as described in the next section.

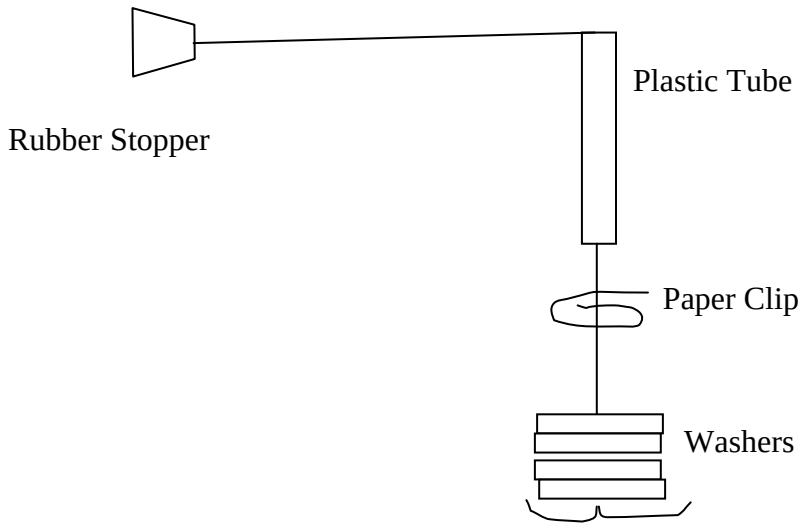

Figure 1 – Centripetal Force Apparatus

Specific Objectives

You will perform a total of seven trials. For each trial the mass of the rubber stopper, and the distance from the stopper to the center of the plastic tube (radius of revolution) will remain the same. Adjust the paper clip on the string until the radius of revolution is 0.5 meters. Starting with 6 washers suspended from the string, you will increase the number of washers suspended from the string by two.

For each trial, hold the plastic tube above your head, and swing the rubber stopper in a horizontal circle. Starting slowly, spin the rubber stopper faster and faster until the paper clip hovers just below the bottom end of the plastic tube (this ensures that the radius of revolution stays at 0.5m). Record the time it takes for the stopper to make 20 revolutions.

When you are finished with your trials, enter the following information into MS Excel (or other spreadsheet).

Trial #	Mass of Stopper (kg)	Mass of Washers (kg)	Weight of Washers (N)	Radius from Tube to Stopper (m)	Time for 20 Revolutions (s)	Angular Velocity (rad/s)	Tangential Velocity (m/s)
1							
2							
3							
4							
5							
6							
7							