

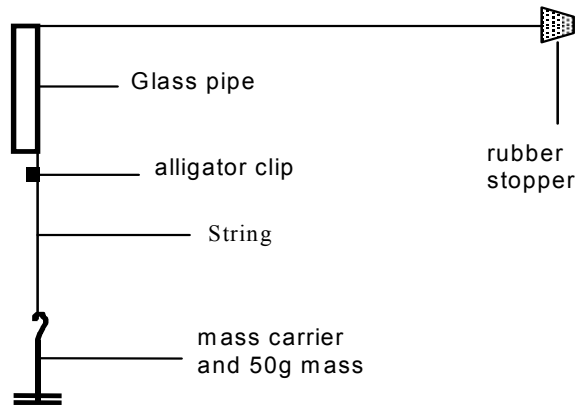
## Circular Motion

**Objectives:** Determine relationship between linear velocity, centripetal force and acceleration.

**Equipment:** stopwatch,  $F_c$  setup, mass set

**Methods:**

1. Prepare setup shown to the right.
2. Hang a 50.0 g mass on the  $F_c$  set up. This mass represents  $F_c$ .
3. Whirl and time the stopper for 10 revs in a horizontal circle while balancing the 50.0 g mass. Be sure the reference washer does not touch the handle.
4. Determine  $T$ , measure  $r$ , then calculate  $f$ ,  $w$ ,  $F_c$ ,  $v$ , and  $a_c$  and write down to the data table. The radius remains constant in this lab.
5. Repeat for various masses to get 5 trials (max. 250 g).



**Analysis:**

1. Plot graphs of:
  - (a)  $F_c - a_c$  ( $a_c$  on the x axis)
  - (b)  $v^2 - a_c$  ( $a_c$  on the x axis)
  - (c)  $V - w$
2. Describe the relationship for each graph. Calculate the slopes for each. What do the slopes represent? (Hint: look at the units for  $y/x$ , then examine your data).
3. Describe how adjustments in the radius  $r$  would affect the mass's velocity given the same  $F_c$ .

**Data Table:**

Radius ( r ) = _____ m							
Mass (g)	Time (s) 10cycles	Period T(s)	Frequency (1/s)	Acceleration (m/s <sup>2</sup> )	Centripetal Force(N)	Linear Velocity (V=m/s)	Angular Velocity (w)
50							
100							
150							
200							
250							

**Useful Formulas:**

1.  $a_c = \frac{v^2}{r}$    2.  $v = \frac{2\pi r}{T}$    3.  $F_c = m \frac{v^2}{r}$    4.  $w = \frac{2\pi}{T} = \frac{v}{r}$    5.  $f = \frac{1}{T}$