NAME_____ DATE_____
PHYSICS A/R - PERIOD ____ MR. LEACOCK

LABORATORY 15
Centripetal Force II

Objective - To determine if the equation:

$$F_c = \frac{mv^2}{r}$$

is valid for an object traveling in a circular path at constant speed.

Diagram - Draw laboratory setup in your lab notebook.

Safety - You must wear goggles for this experiment.

Procedure - PART I - Varying radius

1. Level the apparatus.
2. Find the mass of the black mass.
3. Hang the black mass from the end of the horizontal bar by a cord. Be sure the cord is attached securely to the bar.
4. Loosen the two screws holding the horizontal pointer and move it so it is as close as possible to the rotating shaft.
5. Allow the black mass to hang freely and move the boom so it is aligned with the point on the bottom of the mass.
6. Attach a spring to the vertical pole on the grooved area of the pole. Attach the other end of the spring to an eyelet on the black mass.
7. Attach a cord to a paper clip and hook the paper clip to the other eyelet on the black mass. Run the cord over the pulley and place a weight hanger on the end of the cord.
8. Add mass to the weight hanger until the black masses' pointer is once again aligned with the pointer. Note the force being exerted on the spring to stretch it (F).
9. Measure the distance form the center of the vertical pole to the pointer. Enter this under radius.
10. **Slowly** begin rotating the apparatus until the pointer and the bottom point of the black mass are aligned. Once this occurs maintain this velocity and find the time necessary for 50 revolutions. **UNDER NO CONDITIONS IS THE DEVICE TO ROTATED FASTER THAN THIS OR ROTATED WITHOUT THE SPRING BEING ATTACHED IN ORDER TO PREVENT INJURY TO YOURSELF OR OTHERS.**
11. Find the time required for one revolution.
12. Find the velocity of the black mass.
13. Determine the centripetal force.
14. Repeat the experiment, but move the horizontal pointer to a position at the midpoint of its sliding track, and then to

a position as far away as possible from rotating shaft.

1. Plot F_c (N) (x-axis) vs. r (m) (y-axis) using the force created by the hanging mass as actual force required to stretch the spring, and the centripetal force as the experimental force, find percent error

radius (m)	F (N) Hanging masses	F_c (N) Rotating mass	time for 50 cycles (s)	time for 1 cycle (s)	velocity (v= 2πr / t (m/s))

PART II - Constant radius, varying mass

1. Set the pointer to a midpoint position and repeat steps 5 - 8 and 9 - 17 as in PART I.

2. **Remove the mass. Attach a 50 g** mass to the top of the black mass. Find the total mass. Repeat steps 11 - 16. **BE CERTAIN THE SLOT OF THE ADDED MASS IS POINTING AWAY FROM THE CENTER OF ROTATION.**

3. Repeat the entire procedure with a 100 g mass attached to the black mass.

4. Plot F_c (N) (x-axis) vs. m (kg) (y-axis)

mass (kg)	radius (m)	F (N) Hanging masses	F_c (N) Rotating mass	time for 50 cycles (s)	time for 1 cycle (s)	velocity (v= 2πr / t (m/s))

Questions

1. *Explain why the weight of the hanging masses and the centripetal force for the same data set should be the same.*

2. *For all six trials, consider the weight of the hanging masses as the actual force value and find the percent error versus the centripetal force.*

3. *Describe the relationship between centripetal force and the velocity of an object traveling in a circular path.*

4. *Describe the relationship between centripetal force and the mass of an object traveling in a circular path.*