## *02-07 Centripetal Force Lab* *Name: _____*

*Adapted from Take-Home Physics by Michael Horton*

**Objectives**

- Find the factors that affect centripetal force.

**Materials**

- Centripetal force apparatus

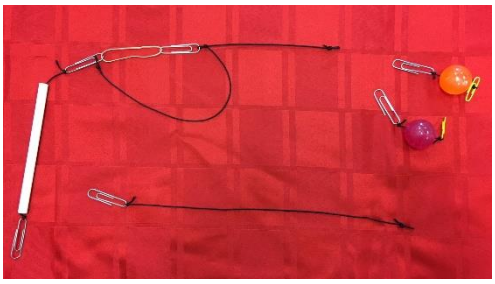

**Figure 1: Centripetal Force Apparatus**

**Procedure**

Newton's 1st Law says that objects in motion will move in a straight line, so if the object is moving in a circle something has to provide a force. This force is called *centripetal* force and is provided by tension in this lab. Today you will find the factors that affect centripetal force.

1. The apparatus consists of a tube with a string running through it. A paper clip keeps it from falling through the tube. One of the paper clips is attached to a rubber band which we will use like a force meter. A loose safety string is also connected across the rubber band so that if the band breaks, the ball will not fly away. The other end of rubber band is attached to a string with a loop on the end. Rubber balls can be hooked to this loop. There is also extra length of string that can be hooked to the loop.
2. Attached one ball to the loop of the apparatus. Make sure the extra length of string is NOT attached.
3. Hold the tube a carefully swing the ball in a horizontal circle. Have your lab partner count off seconds aloud to you. Synchronize your swinging so that the ball comes around **once** per second. Observe the length of the rubber band.
4. Add the second ball and repeat step 3. Was the rubber band stretched longer or shorter? _____
5. The larger the mass of the object, the _____ (more/less) centripetal force it takes to keep it moving in a circle.

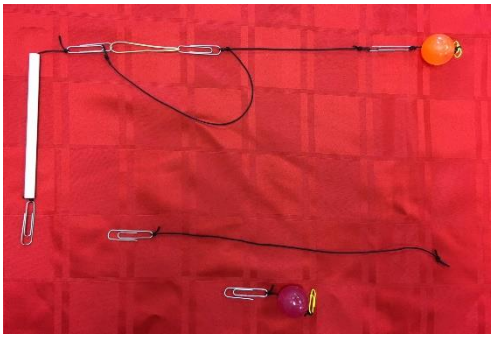

**Figure 2: Step 2**

6. Attach only one ball to the loop of the apparatus and swing the ball **once** per second like in step 3. Observe the length of the rubber band.
7. Now swing the ball **twice** per second and observe the length of the rubber band. Was the rubber band longer or shorter? _____
8. The higher the velocity of the object, the _____(more/less) centripetal force it takes to keep it moving in a circle.
9. Attach only one ball to the loop of the apparatus and swing the ball **twice** per second like in step 3. Observe the length of the rubber band.
10. Unhook the ball. Attach extra length of string to the loop and attach the ball to the other end of the length of string. Swing the ball **once** per second and observe the length of the rubber band. (*Note:* You are swinging the ball once per second because the radius twice as long. This will keep the speed of the ball the same.) Was the rubber band longer or shorter? _____
11. The larger the radius of the circle the object is traveling in, the _____ (more/less) centripetal force it takes to keep it moving in a circle.
12. A direct relationship is when one variable changes, the other changes the same way and can be modeled by $y = kx$. An inverse relationship is when one variable changes, the other changes the opposite way and can be modeled by $y = \frac{k}{x}$.
    a. Are force and mass a direct or inverse relation? _____
    b. Are force and speed a direct or inverse relation? _____
    c. Are force and radius a direct or inverse relation? _____
13. Find the formula for centripetal force in your book or notes. _____ Do the answers from 12 agree with this formula? _____
14. A car will skid when the centripetal force required to make it turn is greater than the force of friction. What are two things the driver could do to lessen the change of a skid in a curve? _____