**CFaA v1**

**FEEL THE FORCE**

**Centripetal Force and Acceleration**

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Hour\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_

Before you begin…,

Imagine something whirling around in a circle (for example, a race car, a skater, a planet or galaxy). How would your group describe how to measure… (You can use words, mathematics or drawing.)

1. The *distance* around a full circle?

2. How much *time* it takes to travel in a full circle?

3. How *fast* the object travels around the circle?

4. How much *force* it takes to move the object around the circle?

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**Centripetal Force and Acceleration**

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Hour\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_

**PURPOSE**: When an object travels around in a circle, what are some relationships among the centripetal force (the inward-pulling force), the radius of the circle, the length of time needed to travel around the circle, the mass of the object, and the object’s velocity around the circle?

|  |  |
| --- | --- |
| **EQUIPMENT**:  safety glasses centripetal force apparatus  stopwatch or timer meter stick electronic balance |  |

**PROCEDURE:**

**Put on your safety glasses!**

Your teacher or classmates will demonstrate how to set up and use the apparatus. Then you will have a chance to try spin the stopper for yourself!

1.Obtain the centripetal force apparatus. Make sure the stopper is tied tightly to the string. Gently pull the string straight until the spring scale reads 1.0 Newtons. Measure and record the length of the string from tip of pole to middle of stopper. Also measure and record the mass of your stopper.

2. Calculate the circumference of the circle that you will make with your spinning stopper. Record.

3. One partner will be the spinner, another partner will be the timer, and another will be recorder. Whirl the stopper over your head and keep the force steady at 1.0 N. Try to keep the circle parallel to the floor. ***Please*** try not to hit your partner or anything else.

4. Spin steadily for 30 revolutions, counting out loud and having your partners measure the time it takes to make the 30 revolutions. Record the time needed for 30 revolutions.

5. Repeat the procedure several times with different forces. Complete the tables.

**DATA and RESULTS:**

**radius of circle \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m (*same for all trials)***

**mass of stopper\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg (*same for all trials)***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Force (N)** | **Circumference of circle of motion (m)** | **Time for 30 revolution (s)** | **Time for 1 revolution (s)** | **Velocity around the circle (m/s)** |
| **0** | **\_\_\_\_\_\_\_\_\_\_****(Measured once; will be the same for all trials)** |  |  |  |
| **1.0** |  |  |  |
| **1.5** |  |  |  |
| **2.0** |  |  |  |
| **2.5** |  |  |  |
| **3.0** |  |  |  |
| **3.5** |  |  |  |
| **4.0** |  |  |  |

**Mathematical hints if you need them:**

Circumference around circle = 2 \* π \* radius

Velocity around the circle = distance around circle = 2 \* π \* radius

 time around the circle time around the circle

**CONCLUSIONS**: Look for patterns in your data:

1. What is the pattern between **force** measurements and the **time** needed for one revolution?
2. What is the pattern between **force** measurements and **velocity**

measurements?

1. If someone used a **radius** different from your radius, what is the pattern between **force** and **radius**? Or, predict what the pattern might be!
2. If someone used a stopper of different **mass** than your mass, what is the pattern between **force** and **mass**? Or, predict what the pattern might be!