Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Physics

Lab – Centripetal Force

1. To study the nature of centripetal force
2. To graph to relationship between centripetal force, mass, radius and velocity.

**Theory**

Sir Isaac Newton stated that a force acting on an object is equivalent to its mass multiplied by its acceleration. Therefore, centripetal force may calculate with the following formula.

F = mV2/R

F = Centripetal Force (Newton)

M = Mass of object (kg)

R = Radius (m)

**Procedures Part 1**

1. Study the apparatus to understand the measurements that must be made.
2. Determine the mass of the rubber stopper and record in the data table.
3. Measure 1 meter from the top of the tube to the end of the stopper. Record this as the radius in the data table. Mark the string at the bottom of the tube for your visual.
4. Support a 50 gram weight hanger in your hand. The weight supplies your centripetal force. Record in the data table in Newtons.
5. Whirl the rubber stopper over your head in a horizontal circle. Adjust the speed to maintain the marked radius. Determine the time needed to make one revolution by timing 0 or more revolutions and calculate.
6. Repeat the procedures above but vary the centripetal force. For the next three trial increase the hanging by adding additional washers.
7. Graph the data showing velocity squared as a function of centripetal force (v2 vs F)

**Data Table 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mass of Stopper (kg)** | **Radius of Motion (m)** | **Hanging mass (kg)** | **Centripetal Force (N)** | **Time of one Revolution (s)** | **Velocity of the Stopper**  **(m/s)** | **Velocity**  **Squared** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Calculations:

1. Centripetal Force 2. Times per revolutions 3. Velocity
2. Using the data from trial one,
3. Calculate what the velocity should have been b) perform an error analysis

**Procedures Part 2**

1. Repeat the procedures from part 1 but this time vary the radius of the motion. Keep Fc and the mass of the stopper constant **.**
2. Record all appropriate data in the data table.
3. Graph the relationship between velocity and radius. Velocity squared as a function of radius (v2 vs r)

**Data Table 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mass of Stopper (kg)** | **Radius of Motion (m)** | **Hanging mass (kg)** | **Centripetal Force (N)** | **Time of one Revolution (s)** | **Velocity of the Stopper**  **(m/s)** | **Velocity**  **Squared** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**Procedure Part 3**

1. Repeat procedures from part one, but this time vary the mass of the object in circular motion. Keep Fc, and radius constant.
2. In successive trial tape 10 g, 20 g, and 30 g, to the orginial mass of the stopper and record in data table.
3. Record all appropriate data.
4. Graph velocity squared as a function of mass (v2 vs m).

**Data Table 3**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Mass of Stopper (kg)** | **Radius of Motion (m)** | **Hanging mass (kg)** | **Centripetal Force (N)** | **Time of one Revolution (s)** | **Velocity of the Stopper**  **(m/s)** | **Velocity**  **Squared** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**Conclusions**

1. What relationship exists between the following: (graph)
2. v2 vs Fc \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. v2 vs r \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. V2 vs m \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Looking from the above, diagram the motion of the rubber stopper if the string breaks.
6. Looking from the side, diagram the motion of the rubber stopper if the string breaks.
7. A man with long arms and a man with short arms are swinging identical pails of water in vertical circles. Which man must swing his pail faster in order to keep the water from falling out? Why?