PHY1002 Physics Laboratory (2022-2023 Term 2)
Short Report

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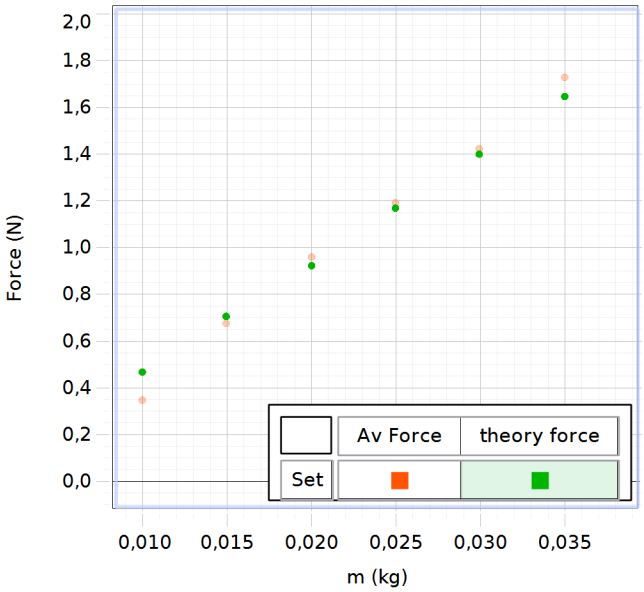
Experiment 6. Centripetal Force

1. Plot the centripetal force (F) vs. mass (m), what is the relationship between them?

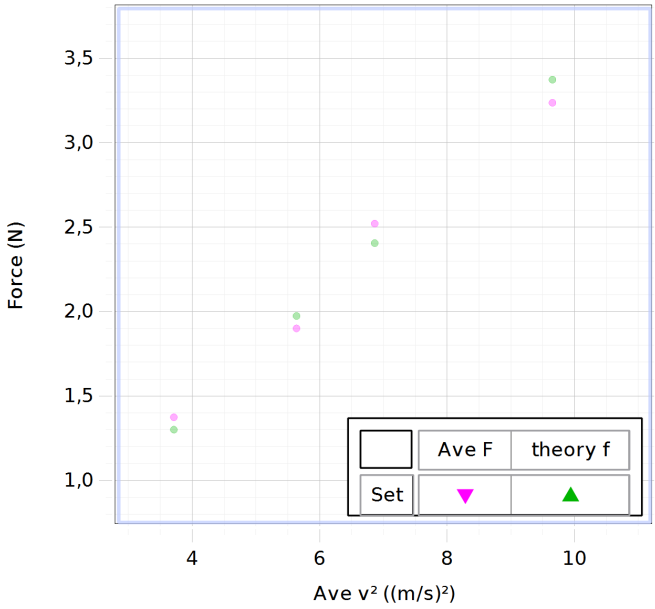


Leaning to the plotted points on the graph, being straight-lined positioned, the trend show a linear relationship between centripetal force and mass. The slope of this line represents the proportionality constant between centripetal force and mass. This is consistent with the formula for centripetal force:

$$F = m\frac{v^2}{r},$$

which shows that the force is directly proportional to the mass.

2. Plot the centripetal force (F) vs. square of the tangential speed (v^2), what is the relationship between them?



Again, from the graph, we can see that there is a linear relationship between the centripetal force and the square of the tangential speed. As the square of the tangential speed increases, the centripetal force also increases. This is consistent with the formula:

$$F = m\frac{v^2}{r},$$

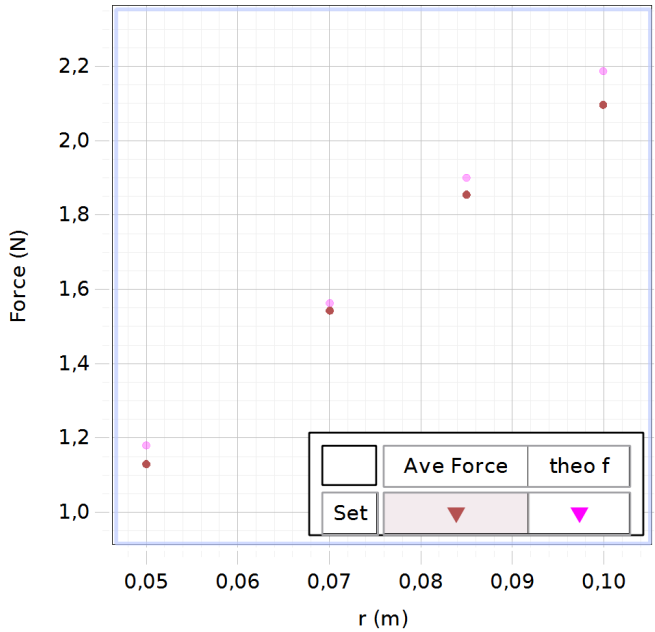
which shows that the centripetal force is proportional to the square of the tangential speed.

3. Plot the centripetal force (F) vs. the radius of the rotating arm (r); what is the relationship between them?

   We measured the relationship between centripetal force and the radius of the circular path using the formula:

$$F = m\omega^2 r$$

   By keeping the mass and angular velocity constant and varying the radius, we were able to observe the effect of the radius on the centripetal force.



The graph of centripetal force vs radius shows a clear straight line as data points overall trend. This demonstrates proportionality constant between the centripetal force and radius variables.

4. Can you verify the equation from the theory $F = mv^2/r$, why? Does the friction between the mass and the rotating arm affect your experiment, how?

   To verify this formula experimentally, we need to measure the mass of the object, the tangential velocity of the object as it moves in a circular path, and the radius of the circle. The experiment effectively shows the proportional relation between the force and the three other variables. By taking some samples from the measured data and compared it with the obtained result, the formula is simply found to be valid.

   Regarding the friction between the mass and the rotating arm, it could potentially affect the experiment if it is not negligible. Friction can introduce an additional force acting on the mass, which could affect the measurement of the centripetal force. Although a small slick ring between the arm and the weight was added, this attempt was mainly pointed to minimize the effect of friction, not removing the effect of friction. Moreover, the rotating arm could have not been balanced properly enough, resulting in any wobbling or vibration that could increase friction. As a result, even after carefully done the experiment, the experiment is truly difficult to achieve a better accuracy.

Appendix

Attach the table in Procedure m, Procedure v, and Procedure r.

mass (kg)	Av speed (m/s)	Av Force (N)
0,010	2,174	0,676
0,015	2,154	0,962
0,020	2,161	1,194
0,025	2,164	1,425
0,030	2,170	1,733

Voltage (V)	Ave v (m/s)	Ave F (N)
5,0	3,107	3,242
4,5	2,622	2,526
4,0	2,376	1,899
3,5	1,930	1,377

r (m)	Ave Speed (m/s)	Ave Force (N)
0,100	2,50	2,098
0,085	2,15	1,856
0,070	1,77	1,541
0,050	1,30	1,130

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