

Centripetal Acceleration

Rotational motion creates some very unique situation. One of those situations is dealing with centripetal acceleration. Centripetal acceleration is defined as the acceleration of an object toward the center of a circular orbit. This force can be caused by many things such as gravity, rope, tires of a car, even your favorite ride at Valleyfair. Since physics is the study of the natural world, we need to be able to analyze and predict the amount of the acceleration. If we can analyze it and predict it we can then calculate the force an object in motion has due to its circular path.

Today's lab is designed to look at the components of centripetal acceleration and to try to predict the magnitude.

<u>Material</u>	<u>Objectives</u>
<ul style="list-style-type: none"> • Vernier Low-g sensor • Record player • Logger Pro • Computer • Stopwatch 	<ul style="list-style-type: none"> • Measure the change in centripetal acceleration of the sensor at different radius lengths and rotational lengths. • Predict the acceleration and force of a mass in three different situations.

Suggested Procedure

<u>Vernier Set Up</u>	<u>Lab Tips</u>	<u>Analysis Tips</u>
<ul style="list-style-type: none"> • Connect the g-sensor into port 1 • Open vernier program and click on experiment, click on Set Up Sensor • Click on Show all sensors and select accelerometer, select low-g • Set collection time 15 seconds • Zero the accelerometer periodically throughout the lab • Set scale of window to 7 N and 0 N 	<ul style="list-style-type: none"> • Measure the radius from center of the turn-table in order to determine the radians/s • Hold the wire above the axis and allow the wire to coil, make sure you <u>gently</u> unwind it before each trial. • Do three trial per speed and distance • Do three different speed and two different distances. • Make a table keeping track of distance from center, player setting and measured acceleration. • Tape the sensor to the surface of the turn-table • Start the table after you have clicked the collect button. • Record the angular speed using a stopwatch. 	<ul style="list-style-type: none"> • Select Curve fit function • Highlight the area where acceleration is constant • Select Linear Fit • Record the y-intercept value (this is your acceleration)



Introduction

Brief description of the experiment itself and why it was being done. Also include the results that you hoped to see. AVOID 1st PERSON!

Theory

- Make sure you give explanations on Centripetal Acceleration, Centripetal Force, Angular Speed
- Predict the results
- Explain what things might affect the results in the lab. In other words why didn't your data turn out perfect

Procedure

- In detail how was the lab equipment set up.
- In detail how were measurements taken.
- In detail how was the data analyzed (Both on Vernier and elsewhere)

Results

- Organize the relevant data into tables. (Be sure the tables are labeled and have a title)
- Create graphs showing the trends observed. Show the Centripetal Acceleration, Angular Speed, and distance for each trial.
- Create graphs showing the trends of at each point that is being analyzed in the lab.

Discussion

- Discuss the trends in the data
- Discuss any errors that may have occurred
- Answer the following questions
 - Do your results support the definition of Centripetal acceleration? Prove it mathematically!
 - Choose three trials and predict the centripetal force for it for the following masses.
 - 100g, 500g, 2kg, 15kg

Conclusion

Bring it all together. What was discovered? How was it done? Why is it important?

suggested Table

Trials	Radius (M)	Angular Speed (rad/s)	Centripetal Acceleration (m/s ²)