

LAB 5: Uniform Circular Motion

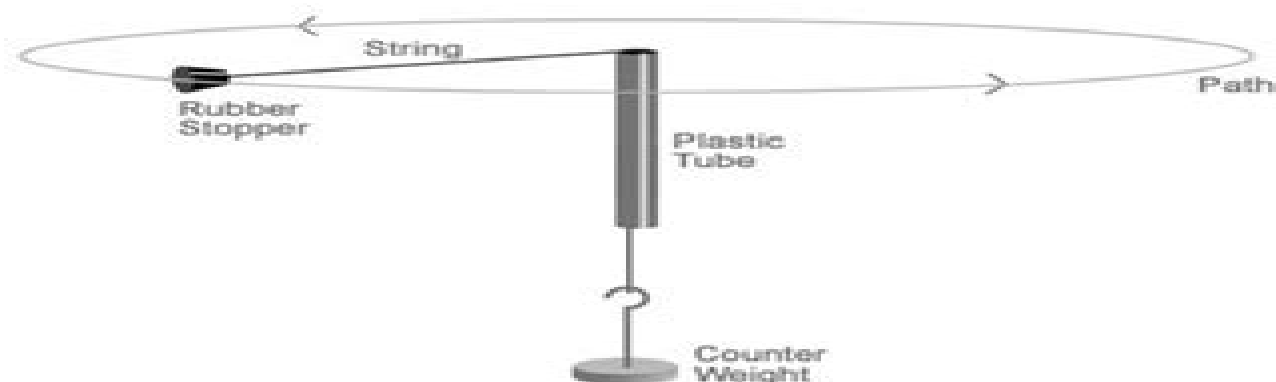
You will need a few formulas from Lab 1 to analyze the data in this lab. Your report should have answers to questions 1 - 13 below.

Review Ch. 6 Sec. 1-3 (and Ch. 10 Sec. 5 for question 14) of the OpenStax textbook for this lab.

According to Newton's first law, objects in motion tend to move along a straight line unless acted on by a force. In order to change the magnitude or direction of velocity, a force must be applied. The force needed to keep an object moving in a circle is called the centripetal force. A centripetal force gives rise to a centripetal acceleration. If the magnitude of centripetal force is constant, the magnitude of centripetal acceleration will be constant as well.

The centripetal acceleration a_c is related to the speed of an object moving in a circle as $a_c = v^2 / r$, where v is the speed and r the radius of the circle.

In this lab, a mass hanging from a string (the counter weight) supplies a constant centripetal force needed to keep a smaller mass (the rubber stopper) going in a circle at a constant speed v . Your goal is to use the data collected in the experiment to verify the above expression for the centripetal acceleration ($a_c = v^2 / r$).



Let M be the mass of the counter weight and m the mass of the rubber stopper. Newton's 2nd law for the stopper is

$$Mg = ma_c$$

- 1) Draw a free body diagram for the system (the stopper, the string, and the counter weight). Justify the relation given above (neglect the fact that the string keeping the stopper on the circular path is not exactly horizontal).
- 2) For an object on a circular path, which direction does the centripetal force vector point?
- 3) For an object on a circular path, which direction does the centripetal acceleration vector point?

Circular Motion Lab Answers

SA Adler



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