PHYS 101 Experiment 3. The Conical Pendulum

Preliminary work:

Review "Example 5.20 A Conical Pendulum" of the textbook. Show that using $R = L\sin\beta,$ where L is the length of the string and R is the radius of the circle traced by the pendulum, and the expression $T = 2\pi\sqrt{(L\cos\beta)/g}$ for the period of the motion in terms of L and the angle $\beta,$ one finds the linear relation

$$T^4 = -\left(\frac{16\pi^4}{g^2}\right)R^2 + \left(\frac{16\pi^4}{g^2}L^2\right).$$

This means that if one plots T^4 (the fourth power of the period) as a function of R^2 (square of the radius) , one has a straight line with slope $-(16\pi^4/g^2)$ and vertical intercept $(16\pi^4 L^2/g^2).$

Online Experiment Link:

https://ophysics.com/

Procedure:

1. Open the website given under the "Online Experiment Link". From the top menu choose the menu item "Forces", and from the appearing drop-down menu choose the experiment "The Conical Pendulum".

2. Read the description given at the bottom of the page. Run the simulation and observe the motion of the conical pendulum.

3. Set the "View Angle" parameter to $\alpha = 90^o.$ This means that you are observing the motion of the pendulum from the top. Set the "Radius" parameter to $R = 3m,$ and check the "Show Grid & Axes" box. Run the simulation and measure the period of the motion. You should describe your method of measurement in your report.

Repeat the procedure for different values of the radius and complete the table below.

$R(m)$	3.0	3.5	4.0	4.5	5.0	5.5	6.0
$T(s)$							

4. Use "Microsoft Excel" or "LibreOffice Calc" to plot of T^4 as a function of R^2 and determine the value of the slope and the vertical intercept of the straight line. For this obtain a "Scatter Plot" first and then use the "Trend Line" function.

5. Use the numerical values of the slope and the intercept to find the length L of the string. Is there another way to find the real value of the length L using the simulation?

6. Write a properly formatted report of your results, convert it into a PDF file and upload it to MOODLE. Deadline for submission is Monday, 27 July 2020 at 07:59 (am.). Late submissions will result in deduction of 10 points for each day late.