MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Physics Department

Physics 8.01 Fall Term 2007

Experiment 02: Circular Motion

Section and Group: 13A

Participants: David Litster

Each group need turn in only one report.

Refer to the discussion about preparing your report on page 7 of the online writeup for this experiemnt. Answer the following four questions.

1. In the table below, fill in the quantities you determined from your experiment; for σ_r = R Std Dev put in the number that was necessary to make $\chi^2 \simeq 1$. In the line below each (except for σ_r), put in what you think is the likely error in the quantity in the form $\pm$ a number. For example, put $\pm$ whatever number you found for σ_r for the error below $r_m(0)$ in the table. The errors for r_0 and ω_c will be their standard deviations obtained from the fit that used the σ_r you entered in the first column.

σ_r (m)	r_0 (m)	ω_c (s^{-1})	m (kg)	k ($\mathrm{N\,m}^{-1}$)	$r_m(0)$ (m)	F_0 (N)
0.0005	0.0435	135.4	0.0085 kg	155.8	0.046	0.39
——	±0.0003	±0.5	± 0	±1.1	±0.0005	±0.09

Notes: if x has error $\pm\,\sigma_x$, then x^2 has error $\pm\,\sigma_{x^2} = \pm\,2\,x\,\sigma_x$. This helps to figure out the error for the force constant k.
If $d = x - y$ and x and y have errors σ_x and σ_y, respectively, the errors in x and y are often assumed to be statistically independent; that means $\sigma_d = \sqrt{\sigma_x^2 + \sigma_y^2}$. This helps when estimating the error in F_0, which comes entirely from the errors in $r_m(0) - r_0$.

2. In view of the discussion on page 7 and the entries in the table above, does Eq. (1) represent your measurements within experimental error?
Very briefly justify your conclusion.

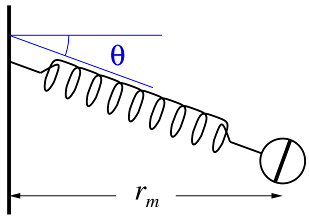
Yes it does. Even if the experimental error is as small as 0.0005 m, Eq. (1) fits the data within experimental error. As the real error is probably at least twice that big, the fit is well within experimental error.

3. Do you think the spring in your apparatus really has an initial tension?
Very briefly justify your conclusion.

Yes I do. Not as firmly established as Eq. (1), but for my data the initial tension is 4 times as big as the error, so I believe it. Your data may have bigger errors than mine, and it's also possible your spring does not have an initial tension.

4. Because of gravity, the spring angles down slightly, as shown exaggerated in the figure to the right. (Hence the name "conical pendulum.")

For the slowest ω that you measured, give a numerical estimate for the angle θ.



Well, my smallest ω *gives* $r_m(\omega)\,\omega^2 = 0.048 \times 39.5^2 = 74.9\,\mathrm{m\,s^{-2}} = 7.65\,g$
thus $\tan\theta = 1/7.65$ or $\theta = 7.5°$.