Laboratory 16 Oct 2006

This is a continuation of the work you started in the laboratory on 10 October last week.

Based on the data you took last week, and the analysis of that data, you should have the following results so far:

- For one pair of springs, measurements of the frequency for different "added" masses
- A plot of $1/\omega^2$ as a function of "added mass" showing a straight line dependence
- Values for the "spring constant" k and the mass of the cart, derived from the slope and intercept of the straight line above. Try to come up with values for the uncertainties on these quantities, from your estimate of the uncertainty on the slope and intercept.
- An independent measurement of k from the extension of the spring from some hanging mass(es). Estimate the uncertainty in k from the extension measurements.
- An independent measurement of the cart mass, using one of the scales in the classroom. (Maybe you used both scales. The difference is a measure of the uncertainty.)

If you didn't get all this done, use some of the time during this class to get this far.

After this is done, you should have discovered two things. First, the spring constants you measured above should differ from each other by a factor of two. *Why?* You should explain your answer by using the equation of motion for the cart, and not just say "it's because there are two springs." Correcting for the factor of two, are the results the same within your uncertainties? Did you measure the spring constant of *each* of the two springs, or did you make the assumption that they were identical? If the latter, maybe you want to check and see how good is that assumption.

Your second discovery should be that the mass of the cart you derive from the straight line is more than that you got from the scale(s). Maybe 10% larger, maybe more, but in any case, well outside your experimental uncertainties. Can you think of a reason for that? Can you think of a way (or ways) to check your reasoning, at least to see if it is a plausible explanation?