Name: ________________________________
Partner(s): ____________________________
1101 Section: __________
Desk # _______________
Date: _________________

Graphing and Simple Harmonic Motion, Part II

Problem 3: Simple Harmonic Motion

Recap:
In Problems 1 and 2, we discovered that we could take a theoretical relationship between measurable variables and calculate something useful from a graph. In order to use a graph's slope, a relationship needs to be linear ($y = slope \cdot x + b$), but if the measured quantities do NOT have a linear relationship, a graph isn't all that helpful as a calculation tool. However, we figured out a way of manipulating the variables to turn the theoretical relationship into a linear one, thus letting us use the slope of its graph to calculate/measure something physically meaningful.

The period, T, of a mass, m, oscillating on a spring, depends on the spring constant, k. By measuring the period for different masses, the spring constant can be found.

$$T = 2\pi\sqrt{\frac{m}{k}}$$

Raw data:	Desired quantity:
Graphing data: x-axis: , y-axis:	Find the desired quantity from the slope of the graph:
Uncertainty for graphing data: $\delta x =$, $\delta y =$	Find the uncertainty of the desired quantity:

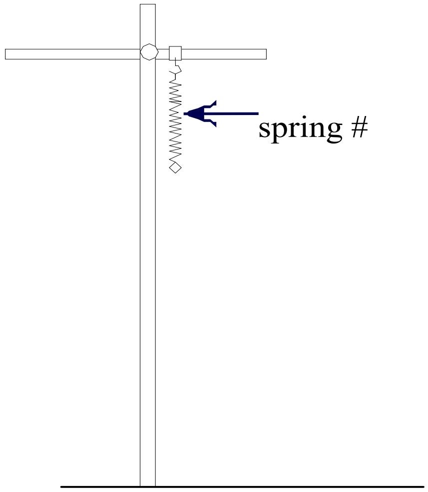
In this experiment, we will measure the period of oscillation by using a stopwatch to get the time for 20 oscillations, t_{20}. From that value, the average period and its uncertainty would be found.

$T = t_{20} / 20$

Now we can assume that δt_{20} is based on your reaction time (ask how you can test this with a stopwatch) and that $\delta T = \delta t_{20}/20$

After all of the data has been collected and the data points for plotting have been figured out, you are ready to graph! And then you can calculate the spring constant.

Apparatus:



Spring # ____

Reference value for spring constant for spring # ____ ___________N/m_

Data:

Time for 20 bounces t_{20} /s	Period T /s	δT /s	Mass m /kg	δm /kg	$x =$	$\delta x =$
			0.500			
			1.500			

Calculations: Plot a graph of your *y vs x* values from the data table.

On the graph, in ink, calculate the following:

- The slope of your "best fit" line: $\text{slope}_{\text{best}}$ (or the slope)
- The slope of your "worst fit" line: $\text{slope}_{\text{worst}}$
- The uncertainty of the slope: $\delta\text{slope} = \left|\text{slope}_{\text{best}} - \text{slope}_{\text{worst}}\right|$

Calculate the spring constant from the graph's best fit slope:

$k =$ (don't round anything yet!!!!!!)

Uncertainty Analysis:

From the uncertainty of the slope, find the relative (and %) and absolute uncertainties of the spring constant.

Conclusions (in proper format):

The spring constant of spring # _____, was measured to be ______________________________.using simple harmonic motion. The reference value from the list in T346 is ______________________.

Discussions: (discrepancy, do the values agree, compare to the results from Problem 1, other comments)