**PHYSICS 1D03 LAB 2 WRITE-UP**

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Partner:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**RESULTS**

**PART 1**

**Hooke’s Law: Load versus Spring Displacement**

**Note: Remember to include absolute uncertainties for every mass and load value with your measurement in the table (the relative uncertainty in mass is 1% as stated).**

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| --- | --- | --- | --- | --- |
| Total mass (kg) |  Mass Uncertainty (kg) | Load (m\*g) (N) |  Load Uncertainty (N) | Pan Position ±0.5 x *103*(m) |
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Part 1: Load versus Spring Displacement Graph

Place the load versus pan position graph here. Make sure to include the trendline on the graph and the R2 value. Include descriptive axis titles.

**PART 2**

**Stored Energy versus Displacement**

(Do not calculate errors for any of these values)

Starting position of slider (xo): ( )

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| Mass (kg) | Position of paper (m) | Change in height, *h* (m) | log*h* | *mh* (kg.m) | log⁡*(mh)* |
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Part 2: Stored Energy versus Displacement Graph

Plot log (mh) versus log (h) here:

**PART 3**

**Mass versus Natural Frequency**

Mass of spring = 2.25 grams

Mass of pan = 50 g

\*\*\*\* Reminder: Do not go past 250 grams! This will overstretch the spring.

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| Mass, m (kg) | Total time for 50 oscillations ± (s) | T ± (s) | $T^{2}$ ($s^{2}$) |
| 0.05± 0.0005 |  |  |  ± |
| 0.06± 0.0006 |  |  |  ± |
| 0.07± 0.0007 |  |  | ± |
| 0.09± 0.0009 |  |  | ± |
| 0.110± 0.001 |  |  | ± |

Part 3. Mass versus Natural frequency graph

Insert your plot of mass *m* versus T2 here:

**DISCUSSION AND CONCLUSIONS**

***Question*** 1. Does your data agree with Hooke’s Law? Explain. If it does, use your graph to determine the spring constant *k*. Make sure your answer is in S.I. units.

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***Question*** 2. Determine the value of *x0* using the trend-line in the graph. Explain what *xo* is in this scenario, referring to Equation (1). Hint: What is another way that you can determine *x0* in the lab, aside from using your graph?

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***Question*** 3. Is the log-log plot consistent with the stored energy varying as *h2*? What did you expect the slope of the line to be? How different is your experimental result from the theoretical value?

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***Question*** 4. Determine the analytic equation for the constant in Eq (6). Show your work to the TA and record your final result.

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***Question*** 5. Is what you obtain for the constant from this graph consistent with what we know about the spring from Part 1? Justify your reasoning and calculate the percent difference between the two values.

Hint: To calculate the percent difference between two values, A and B, use the following formula:

$$\frac{\left|A-B\right|}{(A+B)/2}\*100\%$$

If the answer is *≤10%*, then you may conclude that *A=B* within 10% uncertainty.

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***Question*** 6. What sort of systematic errors does the procedure for Part 2 have with it, and how can we reduce these errors within the lab?

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***Question*** 7. Are your results consistent with your determination of *k* in Part 1? Calculate the % difference between the two values.

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***Question*** 8. Comment on the value of *mo* relative to the mass of the spring. Calculate the % difference between the two values.

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