Directions:

You will write up a final lab report generated with a unique set of data based on your Student ID number.

In addition to opening this document, you will need to open the Excel file, titled *Lab Final*. Read through this entire document and reference the *Lab Report Format Guide* (located in Course Materials) to ensure you get the majority of your points.

Please note: the grading of this 'Final Exam' Lab Report will be highly detailed and looking that all directions are followed.

Grand Canyon University considers academic integrity to be a key Christian ethic. Academic dishonesty includes the use of unauthorized notes, unauthorized collaboration, the copying of another's work and the unauthorized sharing of one's own. Academic dishonesty also includes the disclosure of any part of a quiz or test to others, including the sharing of topics and focus, as well as the sharing of individual questions and/or answers. Academic dishonesty in all forms, including unauthorized collaboration, copying, and the sharing of test information, including verbally, in writing, photographically, or online, will be considered a violation of the University's Code of Conduct and subject to discipline up to and including expulsion.

By typing my name and ID Number I am acknowledging that I have read, understand and accept the above statement.

Name   Jackson Whitmore   ID Number   20859385

Passage: Consider a lab experiment where a spring is hung vertically from an eye-hook screwed into the ceiling. The student attaches a mass to the spring, and displaces it a few centimeters. The student then releases the mass-spring system and measure the time it takes to oscillate back and forth.

1. **Testable Question:**

   How is the period of oscillation of the spring related to the mass on the spring?

2. **Hypothesis:**

   When explaining why the prediction is being made, use **physical** not mathematical arguments. Assume you do not know the formula that the experiment is exploring. Pretend you are the first to do the experiment. Write this up before conducting the lab.

   As the mass on the spring increases (m, kg), the period of oscillation (T, s) will also increase because as the mass gets heavier it will stretch the string more.

3. **Variables:**

   List and identify the different variables used in the experiment. Be sure to include each variable's symbol in parentheses.

   Independent: Mass on spring (m, kg)
   Dependent: Period of oscillation (T, s)
   Controls: Gravity = 9.81 m/s (g, m/s^2), spring constant = 25.0 (k, N/m), displacement of mass (cm)

4. **Design Table:**

   Controls: Gravity = 9.81 m/s (g, m/s^2), spring constant = 25.0 (k, N/m), displacement of mass (cm)

   Make sure the Table Design matches the variables and include units in parentheses. Do not use words for variables; keep things mathematical in tables, on graphs, and in equations. Only use words in the written sections of the lab report. Controls that do not change can be placed either inside or outside the table, **but not both**.

i	m(kg)	T(sec)
1-10		

5. **Materials:**

- Spring
- Various masses
- Eye hook
- Meter stick
- Stopwatch

NO NEED TO ADD "MATERIALS" TO THIS LIST

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6. **Procedure:**

This is a simulation. Follow the instructions in the Excel spreadsheet provided to generate your data.

See excel spreadsheet

7. **Data:**

Controls: Gravity = 9.81 m/s (g, m/s^2), spring constant = 25.0 (k, N/m), displacement of mass (cm)

For your lab report:
Your Data Table will follow the Design Table; keep all other data in your Excel file.
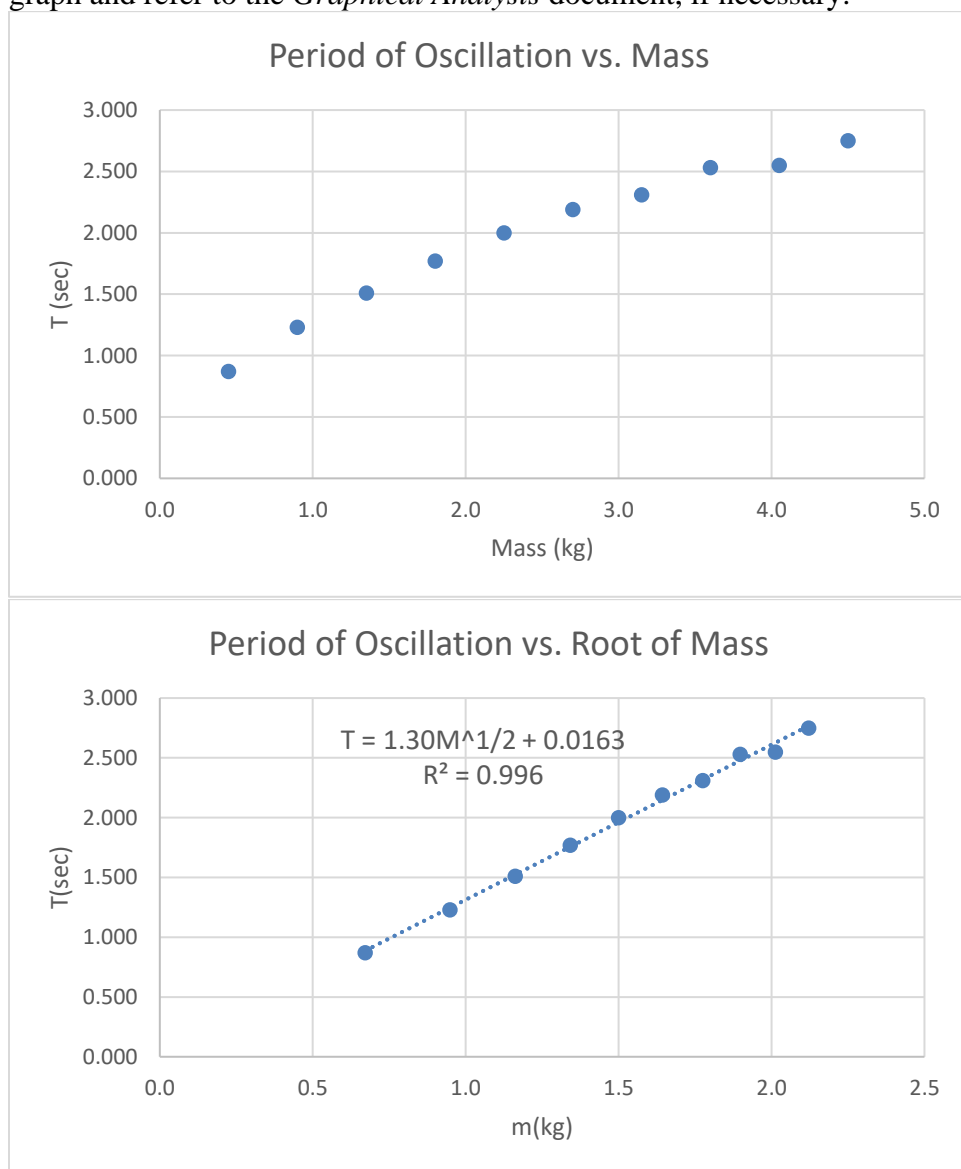Do not use words for the variables. The table must be editable.
The table includes the linearized data column, which is placed next to the independent variable column. Make sure to include the values for your control(s).

m (kg)	T (s)
.450	0.870
.900	1.230
1.350	1.510
1.800	1.770

2.250	2.000
2.700	2.190
3.150	2.310
3.600	2.530
4.050	2.550
4.500	2.750

8. Analysis:

Make the usual initial, raw data graph. If the initial graph is not linear, make a second graph and refer to the *Graphical Analysis* document, if necessary.

Period of Oscillation vs. Mass

Period of Oscillation vs. Root of Mass

$$T = 1.30M^{1/2} + 0.0163$$
$$R^2 = 0.996$$

Identify the applicable equation from your equation sheet. List the formula here and then present the formula to calculate the theoretical slope (TS). Substitute the control value(s) into your expression for TS and present the result to the correct number of significant figures and with the correct unit. Next, present the measured slope (MS) from your graph, with the correct number of significant figures and units, and lastly, calculate the percent error using the formula below.

Ts = 2pi * (m/25.0)^1/2 = 1.35 (I am aware this calculation does not make sense. I am having trouble calculating the theoretical slope and only showing that I am capable of doing the rest of the work.)

Ms = 1.30

%Error = (1.35 – 1.30) / 1.35 = 3.7%

$$\% \; error = \frac{|TS - MS|}{TS} \times 100$$

9. **Conclusion:**

Make sure to write the Conclusion in the form of the Testable Question but now, supplying the answer to the question. Use the specific language of math in describing the relationship and include the equation from the graph with proper symbols, significant figures, and units for the slope. Refer to the *Graphical Analysis* reference sheet for help.

I found that period is directly linear to the root of mass, as shown by my found equation: T = 1.30M^1/2 + 0.0163.

10. **Evaluation:**

No Evaluation is expected or required for this exam.

The report should be submitted in the "*Lab Final Exam*" drop box in HALO as a PDF as directed by your instructor.

When Submitting the Report:

- You may erase the instructions if desired.
- The report must be a single-spaced, Word document with editable the graphs and tables imported from Excel. Use Times New Roman, 12 point, and black (no color in tables or on graph except when there are two lines).
- Use the following to name the lab document: **FINAL_FirstNameLastInitial**
- **Upload to HALO as a PDF!**