FORMAL REPORTS

There will be **two** formal labs completed during the semester. If you are asked to complete a formal laboratory on a given lab, then you do not need to turn in an informal laboratory report for this laboratory. Formal laboratory reports must be **typeset** electronically, using computer word processing and spreadsheet-capable software; nothing can be hand done. You must use **Equation Editor**, which is available in Microsoft Office, or similar equation software, such as the version provided in Open Office, to type equations. Draw any graphs needed using software such as Microsoft Excel. There are campus computer labs available on the 3rd floor of the Science/ Math building and in the library, or you may ask to make arrangements for you to use the computers in the physics laboratory for typing formal reports. See *Density Sample Formal Lab (with error)* for an example of a formal laboratory report.

CONTENT AND LAYOUT FOR FORMAL REPORTS

Formal Lab Requirements

COVER PAGE

This is the first page and includes the following

1) **Title** of the Experiment
2) Your **Number** or Your **Name**
3) Experiment Completion **Date**
4) **Course** (e.g., PH 4A, TTh, Night or Day)
5) The Abstract will be included on the cover page. Following this cover page is the actual laboratory report, starting with the introduction.
6) NOTHING else goes on this page

ABSTRACT

Write a **summary** (no more than 250 words) of the experiment in paragraph form that briefly states:

1) any **Historic** and **Background Information** necessary to understand your report (no more than 2 sentences)
2) the **Purpose(s)** of the experiment (described in Introduction below)
3) list all **Results** to include:
   a) experimental values
   b) theoretical values
   c) percent difference(s) &/or percent discrepancy(ies)

INTRODUCTION/PURPOSE

This is the opening portion for your journal-type lab report, which briefly explains the **Purpose** of the lab in outline form, as follows:

"The purpose of this lab is:" "to use" [state here whatever **apparatus and method** you are supposed to use in the experiment] "to find" [state here whatever **experimental quantities** you are supposed to find], or "to determine" or "to verify" [state here whatever **physical principle(s)** you are supposed to determine or verify], and "to compare this [or these] to" [state here whatever theoretical or other experimental quantity or quantities you are supposed to compare to]

See the example "Introduction" for the "Freely Falling Bodies" lab below (notice that numerical values usually are not given here):

"The purpose of this lab is to use a ball drop apparatus and kinematics to obtain a linear graph, to find, from this graph, an experimental value for the acceleration of gravity in Mission Viejo, and to compare this experimental acceleration to the theoretical acceleration of gravity in Mission Viejo."

EQUIPMENT & IMAGES

1) A list of **equipment** used during the experiment. (If desired, you can label some/all equipment directly on the image described in part 2) below.)
2) **Digital Image** of the **apparatus** in one of the following forms:
   a) a computer drawing program
   b) a photograph of the setup that you took yourself
   c) a picture of the apparatus that you copy from the Web
   d) Image must:
      i) show where all wires and cords connect
      ii) be digitally placed in report
      iii) credit the image to its original source, if any
      iv) NOT be from lab experiment instructions
      v) be different for different classmates (if a photo, change angle from which taken)

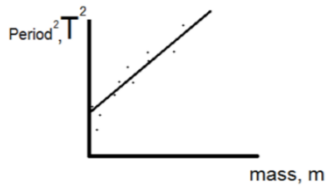
Formal Lab Requirements

THEORY

For Formal labs EVERYTHING must be typed or computerized drawings, including any graphs or diagrams needed to derive your theory

1) Define all symbols/variables used in lab in a table– no need to define units.
2) From Basic Principles, derive and briefly explain in sentences all physics concepts, principles, and theories or equations as you use them in the experiment. Be sure to include percent difference equation.
3) If lab has a graph(s)
   a) Show labeled axes, expected trend line(s) showing linear or other nature, for linear relationships show the approximate y-intercept. (See example A below)

example A



example B

$$T = 2\pi\sqrt{\frac{(m + fm_{sp})}{k}}$$

$$T^2 = (4\pi^2/k)m + (4\pi^2/k)fm_{sp}$$

$$y = slope \cdot x + b$$

   b) Next to the graph(s) write the equation for the trend line in terms of all variables (see example B above).

PROCEDURE

A step by step listing of the how you completed the experiment. (i.e., list steps vertically by number, e.g., 1, 2, 3, etc.)

1) Use **your own words** (as with all parts of report) and do not copy from straight the laboratory instructions.
2) Ideally **write steps down** before you perform the experiment or while you are performing the experiment. Do not wait until you have completed an experiment and analysis to start writing steps down as you may forget some things that were necessary to complete the experiment.
3) **Leave out details** on how to read certain challenging instruments (e.g., Vernier scale), how to use software such as Data Studio or Excel, and how to complete the Analysis.

ANALYSIS

All data must be entered into tables in the analysis, raw data will be attached to the end of the lab report. Graphs must also be inserted into this section and NOT just attached at the end.

1) Data and Calculated values
   a) Must have computerized table with all data.
2) Graphs
   a) Graphs will be inserted into this section and should be approximately half a page in size
   b) Graphs must have a title (ex. Period^2 versus mass), axes labelled with the quantity and the units, display the equation of the best fit curve
3) Calculations
   a) For each type of computation performed during the experiment, provide one sample calculation.

$$v_0 = \Delta x\sqrt{\frac{g}{-2\Delta y}}$$

$$v_0 = (.53\text{ m})\sqrt{\frac{9.80\text{ m/s}^2}{-2(-.67\text{ m})}}$$

$$v_0 = 1.433\text{ m/s}$$

$$v_0 = 1.4\text{ m/s}$$

   b) Determine the difference round to 2 significant figures) accuracy of your experiment using percent difference (For %

$$\text{Percent Difference} = \frac{|\text{Expected value} - \text{Eperimental value}|}{\text{Expected value}} \times 100$$

CONCLUSION

Finally, conclude your work. Conclusions are based on the data collected and supported by the results obtained from the analysis. This must be written in Paragraph, do not list values.

1) **State whether the PURPOSE was MET** by restating the purpose of the experiment.
2) **Discuss Graph(s)**: If there was a **graph, explain/interpret** it. Be sure to comment on the **type of trend line** for the graph, e.g., does it show a linear relationship, quadratic relationship, exponential relationship, etc.?
3) **Results:** restate all results to include the following:
   a) **experimental value(s)** and, if applicable, **theoretical/accepted value(s)**

Formal Lab Requirements

4) Sources of Error (list 3 or more)
   a) For each source of error discuss in one or two sentences how each error affects the results of the experiment.
   b) For example: When measuring vertical height with meter stick, parallax error was neglected. Since the vertical displacement of the projectile is proportional to initial velocity, v_o, then v_o will be off.

APPENDIX:

Questions: (only relevant if there are questions asked in the lab experiment) Write the word “Questions:”. Below that number and type out each question word for word and below each question write your answer.

Raw Data: Include raw data from experiment attached to the end of the formal.