Northeastern University

Report for Experiment #N

Title of the Experiment

Your Name

Lab Partner: Your Partner's Name

TA: Your Instructor's Name

Experiment Date

Abstract (optional, up to +1 credit)

One paragraph with brief description of what was done, which data collected, results of analysis and comparison with theory. Abstract is a compact summary of the Introduction and Conclusion.

*****Style Notes:**

- Reports should be written in *essay form*- no lists or bullet points
- Reports should be written in the past-tense passive voice (e.g. "The length of the cylinder was measured"). *Limited* use of the past-tense first-person is acceptable (e.g. "We measured the length of the cylinder"). The past-tense third person ("The students measured the length of the cylinder") and the present-tense ("The length of the cylinder is measured" or "We measure the length of the cylinder") should be avoided.
- The experiment should be explained in a chronological, logically-connected manner
- The contents of the Introduction, as well as each Investigation, the Conclusion, and the end-of-report Questions, should be placed in their own separate sections
- For an example of a completed report, see the IPL Sample Report (footnote [1] below)

Introduction

Background & Theory

Explain why you did this work. What concepts are you trying to test? Include an overview of the physical phenomena that was studied. You should provide sufficient background information so that someone who is not well-versed in the topic can understand what you were trying to accomplish.

Goals, Methods, & Summary of Procedure

What were the goals of the experiment? You should state, specifically, what quantities were the end-goal of the experiment. Describe how these goals are achieved with the Investigations which data are obtained, and to which theoretical value the data are compared.

Investigation 1

Setup

Describe the experimental setup and how it works. You can add a sketch or a photo if needed.

Procedure

Describe the experimental procedures. What raw data were gathered, and how was the setup used to gather them? How were their uncertainties decided upon? Explain the data collection process in a logically-connected manner. The steps should be described in the order that they were performed, without directly copying from the lab manual. Answer any questions posed in the manual's "procedure" steps for the experiment in question in the order that they appear.[1]

Data (Raw and Derived Quantities

The raw data, derived quantities, and uncertainties shall be gathered in a table as in the example, Table 1, shown below. Include units and appropriate number of significant digits. If the table is too big, reformat it to fit into the page. If there is a prohibitively large amount of raw data, it may be placed into Appendix A. Tables must have captions describing the content.

[1] https://web.northeastern.edu/ipl/wp-content/uploads/2017/09/Sample-Lab-Report.pdf

Example Table

Table 1 – Displacement, time, and velocity measurements (with absolute error) of the puck with the 50g hanging weight.

hanging weight (g)	50					
puck (g)	548					
displacement #	Δx (cm)	Δt (s)	t (s)	δΔx (cm)	v (cm/s)	δv (cm/s)
1	1.9	0.0333	0.033	0.3	28.528	4.504
2	2	0.0333	0.066	0.3	30.030	4.504
3	2.1	0.0333	0.1	0.3	31.531	4.504
4	2.2	0.0333	0.133	0.3	33.033	4.504
5	2.4	0.0333	0.166	0.3	36.036	4.504
6	2.5	0.0333	0.2	0.3	37.537	4.504
7	2.6	0.0333	0.233	0.3	39.039	4.504
8	2.8	0.0333	0.266	0.3	42.042	4.504
9	2.9	0.0333	0.3	0.3	43.543	4.504

Computation of Derived Quantities

How were the derived quantities calculated? If they were calculated via some mathematical technique (e.g. averaging, interpolation, etc.), explain that technique. If they were determined through some physical theory, explain that theory. All important equations should be written out explicitly (including error propagation formulas). Short equations can be written in the text line, e.g. $K = mv^2 / 2$. Longer equations, or ones that are referenced in the text, should be written on their own line, e.g. Eq. (1) below

$$\frac{\delta K}{K} = \frac{\delta v^2}{v^2} = \frac{2\delta v}{v} \qquad (1)$$

If any graphs are created, explain why the data involved must be plotted (e.g. to check linear dependence, to calculate a slope) and how the graph was obtained. Make sure it is properly scaled, has axis labels, units, the trend line and equation for slope, correct error bars, and meaningful captions as in Fig.1 below.

Example Figure

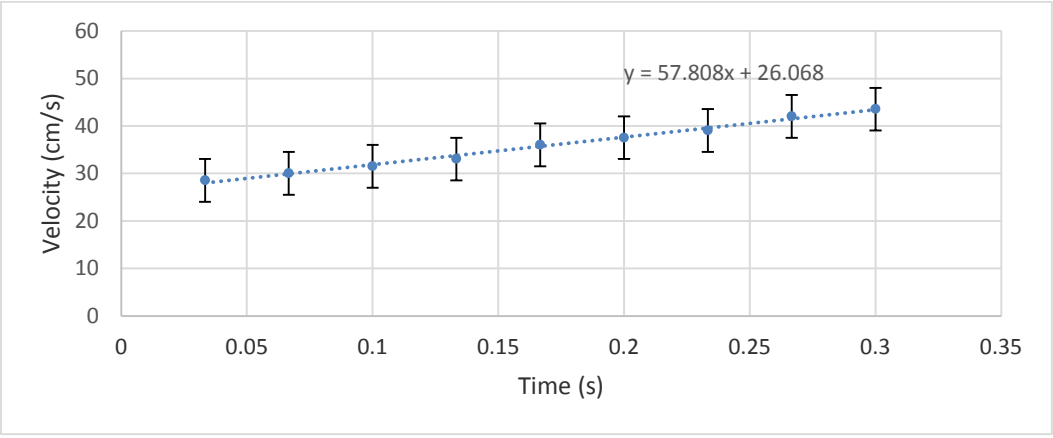

Figure 1 - Acceleration of the puck using a 50g hanging weight.

Results of the Experiment

Explain what is calculated using the derived quantities in the data table or the plotted data. What value was extracted from the graph (slope, y-intercept, exponent factor)? What does it represent? If the desired final value isn't the slope, include the equations necessary to calculate the final value. Include equations used to find the measured value's error. Finally, write down the main results: the measured values +/- their uncertainties (with units and correct significant digits). These values should be the ones you identified as the goals of the experiment in the introduction.

Comparison to Expected Value & Questions in the Procedure

Explicitly state if (or if not) these values are consistent with their expected values given the range of their uncertainties (i.e. were the expected values within the range defined by the uncertainties around the measured values). Answer any questions posed in the "analysis" steps in the manual for the experiment in question.

Analysis of Unaccounted-for Errors

If the results of the experiment were not consistent with the expected values, it is likely that there were other sources of error present that were not accounted-for in your uncertainties. Try to identify some of these sources of error. Be specific; do not just say that you may have made a mistake. Explicitly name a few potential sources of error. Were they random or systematic? Explain how they came about, and quantify them.

Investigation 2

Follows Investigation 1.

Investigation 3 (if applicable)

Follows Investigation 2.

Conclusion

Summary of Procedure

Write a paragraph summarizing the experiment's goals and procedure. Mention the methods of analysis that were used. Provide some detail but do not restate the procedure section.

Summary of Results

Restate all main results and outcomes. Were the goals of the experiment achieved? Discuss how the theoretical expectations outlined in the Introduction have been supported by the experimental data. If your results do not agree with these expectations, restate possible unaccounted-for sources of error that could have caused this.

Possible Improvements

Discuss some possible improvements to the procedure of the experiment. If unaccounted-for errors affected your results, list some changes that could mitigate these.

Questions

Answer each question at the end of the experiment. Honors questions are required for honors sections. Do not simply write the answer; rather, type out the necessary algebra and always include units.

References (optional)

If any resources were consulted, you can refer to them in the report. Examples: "explanation for γ-radiation absorption by solid materials [1]", "applying Eq. (24.9) from [2] to our case", "for current Boston weather conditions (provided by NOAA [3])","taking the density of Al from the NIST database [4]", "references [3,4] are on-line resources, all Refs. [1-4] are cited in the report".

References must be numbered as they appear in the report, and listed in the Reference section:

[1] H. Young and R. Freedman, University Physics, 13th edition, Pearson Education.
[2] O. Batishchev and A. Hyde, Introductory Physics Laboratory, p.263, Hayden-McNeil, 2015.
[3] National Weather Service, http://www.weather.gov/.
[4] National Institute of Standards, http://physics.nist.gov/.

Appendix A (optional, e.g. if data was collected using automated software)

This is for raw data (other than what is in the lab report proper) that was collected but not necessarily used for analysis; includes data from Pasco Capstone or other automated software. Truncate the data down to one page, and keep only significant digits.