PHYS 212 Lab Practicum 1: Information and Guidelines

You will have **1 hour and 15 minutes** to formulate and execute a plan, and prepare a report in response to the prompt you are assigned from the list of three shown below. Use any tools and resources available in the lab to assist you. On the lab bench you will be provided with the prompt assigned to you, all necessary equipment, the Core Elements, and the lab manual. You will also be provided with paper for the written lab report. Bring your lab notebook, a pen, and a calculator with you to the practicum. You may *not* access the Internet, or any previously-created computer files.

Throughout the practicum, **you *must* keep a log of your experimental procedure and reasoning** to be handed in as a final report for the lab practicum grade:

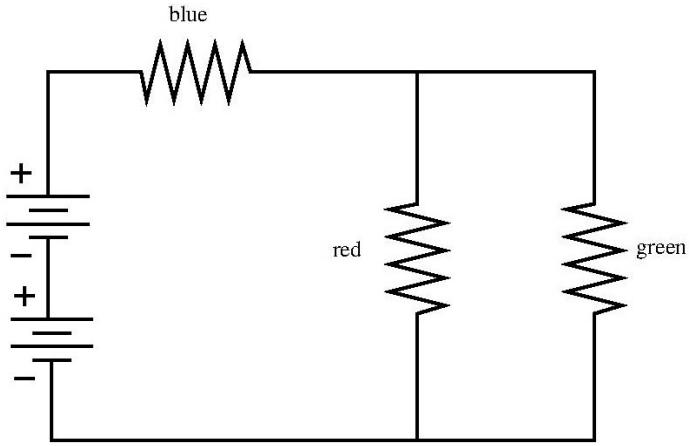
- Use the Core Elements for a lab notebook entry to guide your write-up. The write-up should include appropriate elements such as a lab header, purpose, apparatus (if applicable), procedural details, data, graphs (if applicable), analysis, and a conclusion. At the end of this document, you will find a description of the Assessment Criteria.

- We will scan up to 5 pages (front and back) of your submission, including the cover page. Ideally, your written description should be 1-2 pages, with any Excel or other printouts included as separate sheets, labeled, and referred to in your write-up. **Do NOT cut-and-paste print-outs into your report pages; simply add them as additional pages at the end of your submitted report**. Do not staple.

- Include your name on each page of your report.

You will **not** repeat one of the previous labs. Instead, you will be assigned one of the following three prompts. Some numbers may change in the actual practicum.

Prompt A:



Construct the circuit shown in the figure above. Measure and report the current and voltage for each resistor and battery in the circuit. Draw a circuit diagram and indicate on it exactly how you connected the ammeter and voltmeter to obtain a measurement of the current and voltage associated with the red resistor. Also include a written description of these connections.

Use your measurements to test Kirchhoff's junction rule for **one junction** and Kirchhoff's loop rule for **one loop**. Indicate on your diagram which junction and which loop you chose. In order to verify these rules, you may assume that your final uncertainties are 0.010 A for current, and 0.020 V for voltage.

Write a conclusion including whether your experiments did or did not verify Kirchhoff's rules.

OR

Prompt B: For a laser shining through a single slit, placing the slit at a distance L from the screen will create an interference pattern on the screen with a central maximum of width Δx_c. Using the single slit of width $a = 0.02$ mm, measure five values for Δx_c by positioning the slit wheel at different distances L from the screen.

Determine if there is a linear ($\Delta x_c \propto L$) or inverse-linear ($\Delta x_c \propto \frac{1}{L}$) relationship between L and Δx_c. Use this relationship to predict Δx_c for $L = 1.8$ m.

Write a conclusion including the relationship you found and how you determined it, and your prediction for Δx_c when $L = 1.8$ m.

OR

Prompt C: Set the accelerating voltage on the e/m apparatus to $\Delta V = 215$ V. Measure the corresponding current I of the Helmholtz coils for five different radii of the circular path of the electron beam.

Determine the initial direction of the electron beam when the current is set to 0 and no magnetic field is produced by the Helmholtz coils. Use this to determine the direction of the magnetic field produced by the Helmholtz coils when current is supplied. Explain how you did so.

Then calculate the value of e/m using the template *prompt_eOverm_s2026_template.xlsx*, which is located in the public netspace folder *PHYS 211_212 Lab → 212 Lab → Practicum → Practicum 1*. Note that we assume that the radius of the Helmholtz coils is known to be $a = 0.15$m; therefore, $\Delta a = 0$ and $\Delta(e/m)_a = 0$, but there is still uncertainty due to random error in your measurements.

Write a conclusion reporting your experimental value for e/m with uncertainty, and discuss whether your experimental value is consistent with the expected value $(e/m)_{expected} = 1.75882 \times 10^{11}$ C/kg based on your analysis.

Assessment Criteria

Practicum reports will be assessed according to the following five criteria, each given equal weight (maximum 6 points each for a maximum 30 points total). Of greatest importance is the student's ability to clearly communicate their experiment and interpret their results.

1. A clear, concise statement of the experimental goal.

2. A clear, complete sketch of the apparatus and description of the experimental details, including the procedure used, choices made concerning data collection (equipment used, number of trials, etc.). It should contain enough detail to allow someone else to reproduce the experiment accurately. Where applicable the report should also include a description of uncertainties in the measurement process.

3. A complete record of data collection and presentation. This section may include tables and graphs appropriately labeled and annotated. Since any printouts will be handed in on a separate sheet of paper, figures and tables should be labeled (Fig. 1, Fig. 2, Table 1, Table 2, etc.) and referenced in the report.

4. A clear, concise description of the analysis undertaken to achieve the experiment's goal. This description should include all analysis of uncertainties. Any calculations using the measured data should be clearly documented. If repetitive, then show one representative calculation. If Excel is used, include a printout of the sheet and annotate representative examples for what you typed into the cells.

5. A final statement that summarizes the result of the experiment (quoted in correct format) and the conclusions that can be drawn. If appropriate, this statement should also include comparisons between experimental measurements and expected values.