

Preparation of Lab Reports for Physics 372 (January 2007)

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Abstract—These instructions give you guidelines for preparing reports for Physics 372. Use this document as a template if you are using Microsoft *Word* 6.0 or later. Otherwise, use this document as an instruction set. Define all symbols used in the abstract. Do not cite references in the abstract. Do not delete the blank line immediately above the abstract; it sets the footnote at the bottom of this column.

Index Terms—About four key words or phrases in alphabetical order, separated by commas. Use your imagination.

I. INTRODUCTION

THIS document is a template for Microsoft *Word* versions 6.0 or later. If you are reading a paper version of this document, please download the electronic file, P372-Report.doc from <http://www.phys.uregina.ca/phys372> so you can use it to prepare your manuscript. If you would prefer to use LATEX, download the LATEX style and sample files from the same Web page. Use these LATEX files for formatting, but please follow the instructions in P372-Report.doc or P372-Report.pdf.

When you download and open P372-Report.doc, select “Page Layout” from the “View” menu in the menu bar (View | Page Layout), which allows you to see the footnotes. Then type over sections of P372-Report.doc or cut and paste from another document and then use markup styles. The pull-down style menu is at the left of the Formatting Toolbar at the top of your *Word* window (for example, the style at this point in the document is “Text”). Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. The style will adjust your fonts and line spacing. **Do not change the font sizes or line spacing to squeeze more text into a limited number of pages.** Use italics for emphasis; do not underline.

To insert images in *Word*, position the cursor at the

Report received January 24, 2007. (Write the date on which you submitted your report for grading.) Paper titles should be written in uppercase and lowercase letters, not all uppercase. Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., “Nd-Fe-B”). Do not write “(Invited)” in the title. Full names of authors are preferred in the author field, but are not required. Put a space between authors’ initials.

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insertion point and either use Insert | Picture | From File or copy the image to the Windows clipboard and then Edit | Paste Special | Picture (with “Float over text” unchecked).

Please preserve the formatting in this template. Please observe the page limits (maximum six pages) as explained in class.

II. PROCEDURE FOR REPORT SUBMISSION

A. Preparation Stage

You will need to submit your report by hard copy and electronically for review. For the hard copy, submit one copy such that only one column appears per page. This will give your instructors plenty of room to write comments. Submit a second copy in two-column format electronically (by email to zisis@uregina.ca), so that the overall formatting and layout can be graded.

For the one-column format, please do the following:

--First, click on the View menu and choose Print Layout.

--Second, place your cursor in the first paragraph. Go to the Format menu, choose Columns, choose one column Layout, and choose “apply to whole document” from the dropdown menu.

--Third, click and drag the right margin bar to just over 4 inches in width.

The graphics will stay in the “second” column, but you can drag them to the first column. Make the graphic wider to push out any text that may try to fill in next to the graphic.

B. Submission Stage

When you are ready to submit your final version, after your instructor has approved the contents of your lab book, print one copy in one-column format, including figures and tables, as described above.

You must also submit your two-column final report by email, in both Word and PDF format to the above email address.

C. Figures

All tables and figures will be processed as images in your report. However, if this was a journal paper, you would have been asked to submit enlarged versions of the tables and figures separately as the journal cannot extract those embedded in your document. (In that case, the figures and tables you insert in your document are only to help you gauge the size of your paper, for the convenience of the referees, and

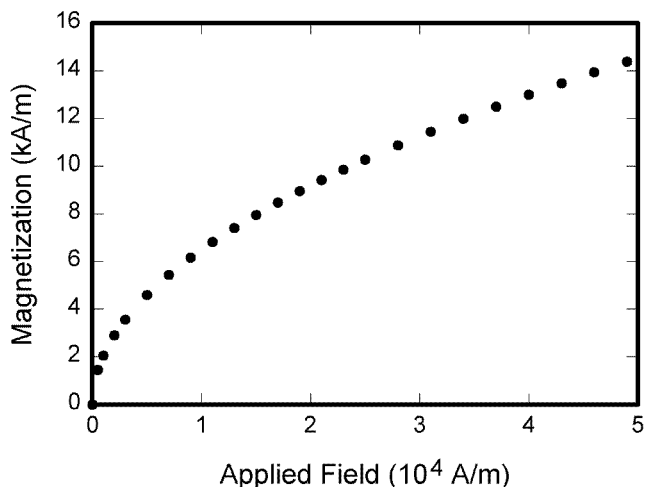


Fig. 1. Magnetization as a function of applied field. Note that “Fig.” is abbreviated. There is a period after the figure number, followed by two spaces. It is good practice to explain the significance of the figure in the caption.

to make it easy for you to distribute preprints.) This is not a concern for Physics 372.

D. Electronic Image Files (Optional)

You will have the greatest control over the appearance of your figures if you are able to prepare electronic image files. If you do not have the required computer skills, just submit paper prints as described above and skip this section.

1) *Easiest Way*: If you have a scanner, the best and quickest way to prepare noncolor figure files is to print your tables and figures on paper exactly as you want them to appear, scan them, and then save them to a file in PostScript (PS) or Encapsulated PostScript (EPS) formats. Use a separate file for each image. File names should be of the form “fig1.ps” or “fig2.eps.”

2) *Slightly Harder Way*: Using a scanner as above, save the images in TIFF, JPEG or GIF format. High-contrast line figures and tables should be prepared with 600 dpi resolution and saved with no compression, 1 bit per pixel (monochrome), with file names of the form “fig3.tif” or “table1.tif.” To obtain a 3.45-in figure (one-column width) at 600 dpi, the figure requires a horizontal size of 2070 pixels. Typical file sizes will be on the order of 0.5 MB.

Photographs and grayscale figures should be prepared with 220 dpi resolution and saved with no compression, 8 bits per pixel (grayscale). To obtain a 3.45-in figure (one-column width) at 220 dpi, the figure should have a horizontal size of 759 pixels.

Color figures should be prepared with 400 dpi resolution and saved with no compression, 8 bits per pixel (palette or 256 color). To obtain a 3.45-in figure (one column width) at 400 dpi, the figure should have a horizontal size of 1380 pixels.

The above numbers are to be used only as broad guidelines. However, please ensure that the size of your report on disk is not significantly larger than 1 MB. Consult your instructor if you exceed this limit **BEFORE** submitting your report by email or hardcopy.

3) *Other Ways*: Experienced computer users can either

create or convert figures and tables from their original format to TIFF, JPEG or GIF. Please consult the information sheets posted in LB129 and LB131 for an application suitable to your needs.

The information in the next four paragraphs is not required for Physics 372. The instructions below are general for your knowledge and future use. They may not be applicable to all versions of Microsoft products.

Here is a way to make TIFF image files of tables, if you so desire. First, create your table in *Word*. Use horizontal lines but no vertical lines. Hide gridlines (Table | Hide Gridlines). Spell check the table to remove any red underlines that indicate spelling errors. Adjust magnification (View | Zoom) such that you can view the entire table *at maximum area* when you select View | Full Screen. Move the cursor so that it is out of the way. Press “Print Screen” on your keyboard; this copies the screen image to the Windows clipboard. Open Microsoft *Photo Editor* and click Edit | Paste as New Image. Crop the table image (click Select button; select the part you want, then Image | Crop). Adjust the properties of the image (File | Properties) to monochrome (1 bit) and 600 pixels per inch. Resize the image (Image | Resize) to a width of 3.45 inches. Save the file (File | Save As) in TIFF with no compression (click “More” button).

Most graphing programs allow you to save graphs in TIFF; however, you often have no control over compression or number of bits per pixel. You should open these image files in a program such as Microsoft *Photo Editor* and re-save them using no compression, either 1 or 8 bits, and either 600 or 220 dpi resolution (File | Properties; Image | Resize). See Section II-D2 for an explanation of number of bits and resolution. If your graphing program cannot export to TIFF, you can use the same technique described for tables in the previous paragraph.

A way to convert a figure from Windows Metafile (WMF) to TIFF is to paste it into Microsoft *PowerPoint*, save it in JPG format, open it with Microsoft *Photo Editor* or similar converter, and re-save it as TIFF.

Microsoft *Excel* allows you to save spreadsheet charts in Graphics Interchange Format (GIF). To get good resolution, make the *Excel* charts *very* large. Then use the “Save as HTML” feature). You can then convert from GIF to TIFF using Microsoft *Photo Editor*, for example. No matter how you convert your images, it is a good idea to print the TIFF files to make sure nothing was lost in the conversion.

Since you will be using this template for all reports in Physics 372, you should save it as “P372-ExperimentName-AuthorName.doc or .pdf. For experiment name please use “Circuits”, “Kater”, “Cavendish”, “Speed”, “Millikan”, and “Rutherford”. For author name please use your last name and first initial; e.g. “P372-Cavendish-SmithA.doc”.

E. Copyright Form

A Journal copyright form would accompany your final submission, if this were a journal paper. You can get a .pdf, .html, or .doc version from the web pages of the journal or from the first issues in each volume of the journal. Authors are responsible for obtaining any security clearances.

III. MATH

If you are using *Word*, use either the Microsoft Equation Editor or the *MathType* add-on (<http://www.mathtype.com>) for equations in your paper (Insert | Object | Create New | Microsoft Equation or MathType Equation). “Float over text” should *not* be selected.

IV. UNITS

Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.) English units may be used as secondary units (in parentheses). **This applies to papers in data storage.** For example, write “15 Gb/cm² (100 Gb/in²).” An exception is when English units are used as identifiers in trade, such as “3½ in disk drive.” Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity in an equation.

The SI unit for magnetic field strength *H* is A/m. However, if you wish to use units of T, either refer to magnetic flux density *B* or magnetic field strength symbolized as $\mu_0 H$. Use the center dot to separate compound units, e.g., “A·m².”

V. HELPFUL HINTS

A. Figures and Tables

Position figures and tables appropriately throughout the text. This means that figures and tables should be near and following their reference in the text. Large figures and tables may span both columns. Place figure captions below the figures; place table titles above the tables. If your figure has two parts, include the labels “(a)” and “(b)” as part of the artwork. Please verify that the figures and tables you mention in the text actually exist. **Please do not include captions as part of the figures. Do not put captions in “text boxes” linked to the figures. Do not put borders around the outside of your figures.** Use the abbreviation “Fig.” even at the beginning of a sentence. Do not abbreviate “Table.” Tables are numbered with Roman numerals.

Color printing of figures is allowed. **However, do not use color unless it is necessary for the proper interpretation of your figures.**

Figure axis labels are often a source of confusion. Use words rather than symbols. As an example, write the quantity “Magnetization,” or “Magnetization *M*,” not just “*M*.” Put units in parentheses. Do not label axes only with units. As in

TABLE I
UNITS FOR MAGNETIC PROPERTIES

Symbol	Quantity	Conversion from Gaussian and CGS EMU to SI ^a
Φ	magnetic flux	1 Mx \rightarrow 10 ⁻⁸ Wb = 10 ⁻⁸ V·s
<i>B</i>	magnetic flux density, magnetic induction	1 G \rightarrow 10 ⁻⁴ T = 10 ⁻⁴ Wb/m ²
<i>H</i>	magnetic field strength	1 Oe \rightarrow 10 ³ /(4 π) A/m
<i>m</i>	magnetic moment	1 erg/G = 1 emu \rightarrow 10 ⁻³ A·m ² = 10 ⁻³ J/T
<i>M</i>	magnetization	1 erg/(G·cm ³) = 1 emu/cm ³ \rightarrow 10 ³ A/m
4 π <i>M</i>	magnetization	1 G \rightarrow 10 ³ /(4 π) A/m
σ	specific magnetization	1 erg/(G·g) = 1 emu/g \rightarrow 1 A·m ² /kg
<i>j</i>	magnetic dipole moment	1 erg/G = 1 emu \rightarrow 4 π × 10 ⁻¹⁰ Wb·m
<i>J</i>	magnetic polarization	1 erg/(G·cm ³) = 1 emu/cm ³ \rightarrow 4 π × 10 ⁻⁴ T
χ, κ	susceptibility	1 \rightarrow 4 π
χ_p	mass susceptibility	1 cm ³ /g \rightarrow 4 π × 10 ⁻³ m ³ /kg
μ	permeability	1 \rightarrow 4 π × 10 ⁻⁷ H/m = 4 π × 10 ⁻⁷ Wb/(A·m)
μ_r	relative permeability	$\mu \rightarrow \mu_r$
<i>w, W</i>	energy density	1 erg/cm ³ \rightarrow 10 ⁻¹ J/m ³
<i>N, D</i>	demagnetizing factor	1 \rightarrow 1/(4 π)

No vertical lines in table. Statements that serve as captions for the entire table do not need footnote letters.

^aGaussian units are the same as cgs emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

Fig. 1, for example, write “Magnetization (A/m)” or “Magnetization (A·m⁻¹),” not just “A/m.” Do not label axes with a ratio of quantities and units. For example, write “Temperature (K),” not “Temperature/K.”

Multipliers can be especially confusing. Write “Magnetization (kA/m)” or “Magnetization (10³ A/m).” Do not write “Magnetization (A/m) × 1000” because the reader would not know whether the top axis label in Fig. 1 meant 16000 A/m or 0.016 A/m. Figure labels should be legible, approximately 8 to 12 point type.

B. References

Number citations consecutively in square brackets [1]. The sentence punctuation follows the brackets [2]. Multiple references [2], [3] are each numbered with separate brackets [1]–[3]. When citing a section in a book, please give the relevant page numbers [2]. In sentences, refer simply to the reference number, as in [3]. Do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] shows” Do not use automatic endnotes in *Word*; type the reference list at the end of the paper using the “References” style.

Number footnotes separately in superscripts (Insert | Footnote).¹ Place the actual footnote at the bottom of the column in which it is cited; do not put footnotes in the reference list (endnotes). Use letters for table footnotes (see Table I).

¹It is recommended that footnotes be avoided (except for the unnumbered footnote with the receipt date on the first page). Instead, try to integrate the footnote information into the text.

Please note that the references at the end of this document are in the preferred referencing style. Give all authors' names; do not use "*et al.*" unless there are six authors or more. Use a space after authors' initials. Papers that have not been published should be cited as "unpublished" [4]. Papers that have been submitted for publication should be cited as "submitted for publication" [5]. Papers that have been accepted for publication, but not yet specified for an issue should be cited as "to be published" [6]. Please give affiliations and addresses for private communications [7].

Capitalize only the first word in a paper title, except for proper nouns and element symbols. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [8].

C. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract. Commonly used abbreviations such as APS, PRL, ac, and dc do not have to be defined. Abbreviations that incorporate periods should not have spaces: write "C.N.R.S.," not "C. N. R. S.," Do not use abbreviations in the title unless they are unavoidable.

D. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). First use the equation editor to create the equation. Then select the "Equation" markup style. Press the tab key and write the equation number in parentheses. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Use parentheses to avoid ambiguities in denominators. Punctuate equations when they are part of a sentence, as in

$$\int_0^{r_2} F(r, \varphi) dr d\varphi = [\sigma r_2 / (2\mu_0)] \int_0^\infty \exp(-\lambda |z_j - z_i|) \lambda^{-1} J_1(\lambda r_2) J_0(\lambda r_i) d\lambda. \quad (1)$$

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Italicize symbols (*T* might refer to temperature, but *T* is the unit tesla). Refer to "(1)," not "Eq. (1)" or "equation (1)," except at the beginning of a sentence: "Equation (1) is"

E. Other Recommendations

Use one space after periods and colons. Hyphenate complex modifiers: "zero-field-cooled magnetization." Avoid dangling participles, such as, "Using (1), the potential was calculated." [It is not clear who or what used (1).] Write instead, "The potential was calculated by using (1)," or "Using (1), we calculated the potential."

Use a zero before decimal points: "0.25," not ".25." Use "cm³," not "cc." Indicate sample dimensions as "0.1 cm × 0.2 cm," not "0.1 × 0.2 cm²." The abbreviation for "seconds" is "s," not "sec." Do not mix complete spellings and abbreviations of units: use "Wb/m²" or "webers per square

meter," not "webers/m²." When expressing a range of values, write "7 to 9" or "7-9," not "7~9."

A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.) In American English, periods and commas are within quotation marks, like "this period." Other punctuation is "outside"! Avoid contractions; for example, write "do not" instead of "don't." The serial comma is preferred: "A, B, and C" instead of "A, B and C."

If you wish, you may write in the first person singular or plural and use the active voice ("I observed that ..." or "We observed that ..." instead of "It was observed that ..."). Use the chosen voice consistently throughout the document. Remember to check spelling. If your native language is not English, please get a native English-speaking colleague to proofread your paper.

VI. SOME COMMON MISTAKES

The word "data" is plural, not singular. The subscript for the permeability of vacuum μ_0 is zero, not a lowercase letter "o." Use the word "micrometer" instead of "micron." A graph within a graph is an "inset," not an "insert." The word "alternatively" is preferred to the word "alternately" (unless you really mean something that alternates). Use the word "whereas" instead of "while" (unless you are referring to simultaneous events). Do not use the word "essentially" to mean "approximately" or "effectively." Do not use the word "issue" as a euphemism for "problem."

Be aware of the different meanings of the homophones "affect" (usually a verb) and "effect" (usually a noun), "complement" and "compliment," "discreet" and "discrete," "principal" (e.g., "principal investigator") and "principle" (e.g., "principle of measurement"). Do not confuse "imply" and "infer."

Prefixes such as "non," "sub," "micro," "multi," and "ultra" are not independent words; they should be joined to the words they modify, usually without a hyphen. There is no period after the "et" in the Latin abbreviation "*et al.*" (it is also italicized). The abbreviation "i.e.," means "that is," and the abbreviation "e.g.," means "for example" (these abbreviations are not italicized).

An excellent style manual and source of information for science writers is [9]. Additional information may be obtained from the general Physics style guides on *Manuscript Submission*, is available at <http://authors.aps.org/tips.html> or at http://www.elsevier.com/wps/find/journaldescription.cws_home/505705/authorinstructions.

VII. EDITORIAL POLICY

The information in the next three paragraphs is for your own knowledge and not applicable to your reports for Physics 372.

Submission of a manuscript is not required for participation

in a conference. Do not submit a reworked version of a paper you have submitted or published elsewhere. Do not publish “preliminary” data or results. The submitting author is responsible for obtaining agreement of all coauthors and any consent required from sponsors before submitting a paper. It is the obligation of the authors to cite relevant prior work.

Many JOURNALS do not publish conference records or proceedings. Some JOURNALS do publish papers related to conferences that have been recommended for publication on the basis of peer review. As a matter of convenience and service to the technical community, these topical papers may be collected and published in one issue of the journal.

At least two reviews are required for every paper submitted. For conference-related papers, the decision to accept or reject a paper is made by the conference editors and publications committee; the recommendations of the referees are advisory only. **Undecipherable English is a valid reason for rejection.** Authors of rejected papers may revise and resubmit them to the JOURNAL as regular papers, whereupon they will be reviewed by two new referees.

VIII. PUBLICATION PRINCIPLES

The contents of practically all JOURNALS are peer-reviewed and archival. Each JOURNAL publishes scholarly articles of archival value as well as tutorial expositions and critical reviews of classical subjects and topics of current interest.

Authors should consider the following points:

- 1) Technical papers submitted for publication must advance the state of knowledge and must cite relevant prior work.
- 2) The length of a submitted paper should be commensurate with the importance, or appropriate to the complexity, of the work. For example, an obvious extension of previously published work might not be appropriate for publication or might be adequately treated in just a few pages.
- 3) Authors must convince both peer reviewers and the editors of the scientific and technical merit of a paper; the standards of proof are higher when extraordinary or unexpected results are reported.
- 4) Because replication is required for scientific progress, papers submitted for publication must provide sufficient information to allow readers to perform similar experiments or calculations and use the reported results. Although not everything need be disclosed, a paper must contain new, useable, and fully described information. For example, a specimen's chemical composition need not be reported if the main purpose of a paper is to introduce a new measurement technique. Authors should expect to be challenged by reviewers if the results are not supported by adequate data and critical details.
- 5) Papers that describe ongoing work or announce the latest technical achievement, which are suitable for presentation at a professional conference, may not be appropriate for publication in a TRANSACTIONS or JOURNAL.

IX. CONCLUSION

A brief conclusion section is required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendices, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g.” Use the singular heading even if you have many acknowledgments. Avoid expressions such as “One of us (S.B.A.) would like to thank” Instead, write “F. A. Author thanks” **I wish to thank Drs. P. Bergbusch and Z. Papandreou for their assistance and advice.**

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First A. Author (M'76–SM'81–F'87) and the other authors may include biographies at the end of regular papers. Biographies are often not included in conference-related papers. This author became a Member (M) of IEEE in 1976, a Senior Member (SM) in 1981, and a Fellow (F) in 1987. The first paragraph may contain a place and/or date of birth (list place, then date). Next, the author's educational background is listed. The degrees should be listed with type of degree in what field, which institution, city, state or country, and year degree was earned. The author's major field of study should be lower-cased.

The second paragraph uses the pronoun of the person (he or she) and not the author's last name. It lists military and work experience, including summer and fellowship jobs. Job titles are capitalized. The current job must have a location; previous positions may be listed without one. Information concerning previous publications may be included. Try not to list more than three books or published articles. The format for listing publishers of a book within the biography is: title of book (city, state: publisher name, year) similar to a reference. Current and previous research interests ends the paragraph.

The third paragraph begins with the author's title and last name (e.g., Dr. Smith, Prof. Jones, Mr. Kajor, Ms. Hunter). List any memberships in professional societies other than the IEEE. Finally, list any awards and work for IEEE committees and publications. If a photograph is provided, the biography will be indented around it. The photograph is placed at the top left of the biography. Personal hobbies will be deleted from the biography.