

Grading Rubric for Laboratory Reports  
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**Accuracy**

A	B	C	D	F
The paper contains no false statements.	The paper contains one or two false statements, indicating an incomplete or naive understanding of the assumptions and principles of physics underlying the experiment, the design of the experiment, the procedure, or data analysis.	The paper contains several false statements, indicating a weak understanding of the assumptions and principles of physics underlying the experiment, the design of the experiment, the procedure, or data analysis.	The paper contains one or more false statements of such magnitude and significance that the credibility of the author is suspect.	The paper contains numerous false statements to the extent that the author has lost all credibility with the reader.

**Precision**

A	B	C	D	F
The language is exquisitely precise, leaving no room for error in the interpretation of the author's statements.	Imprecise statements are infrequent and only occasionally distracting.	Imprecise statements are frequent and distracting, indicating a weak understanding of the assumptions and principles of physics underlying the experiment, the design of the experiment, the procedure, or data analysis.	Imprecise statements force the reader to stop and decipher the author's intent.	Numerous statements are imprecise to the extent that the reader cannot decipher the author's intent.

## Completeness

A	B	C	D	F
<p>All arguments are complete (at a level appropriate for an audience of the author's peers).</p> <p>The author has provided sufficient detail that the reader can readily reproduce the experiment and the final results (from the data provided in the paper).</p>	<p>Gaps in the logic (typically, non sequiturs) are minor and easily overcome by the reader.</p> <p>Omissions are minor and infrequent. The reader can reproduce the experiment and the final results (from the data provided in the paper) with a little effort.</p>	<p>Gaps in the logic are significant and require a moment of reflection on the part of the reader to overcome.</p> <p>Omissions are minor but frequent, making the result of the experiment suspect. The (experienced) reader can reproduce the experiment and the final results (from the data provided in the paper) with some effort.</p>	<p>Gaps in the logic are significant to the extent the reader must stop and do serious work to overcome those gaps.</p> <p>Omissions are significant, requiring even the most experienced reader to stop and do serious work to reproduce the experiment and the final results (from the data provided in the paper). Omissions are not so severe that the experiment and its result are implausible.</p>	<p>Arguments are so incomplete that great leaps of faith are required by the reader to believe the result of the experiment.</p> <p>The author has omitted significant details such that the experiment is irreproducible, or worse, inconceivable. The author has lost all credibility with the reader.</p>

## Convention

A	B	C	D	F
<p>The paper conforms to all established conventions.</p>	<p>Formatting errors are infrequent and only occasionally distracting.</p>	<p>Formatting errors are frequent and distracting.</p>	<p>Formatting errors are significant, affecting the interpretation of the data.</p>	<p>The paper seriously diverges from established conventions.</p>

## Abstract

A	B	C	D	F
<p>The abstract captures the essence of the experiment (the abstract states succinctly the chain of logic, that makes it possible to obtain the final results).</p> <p>The abstract captures the interest of the reader.</p> <p>The results of the experiment are stated clearly and placed in context with at least one other result from the professional literature.</p>	<p>The abstract summarizes the experiment (the abstract includes the physical quantities measured and calculated during the experiment, the relationships between them, the methods used to obtain data, and the methods used to arrive at the final result) but does not quite capture the essence of the experiment.</p> <p>The results of the experiment are stated clearly and and placed in context with at least one other result from the professional literature.</p>	<p>The abstract includes the physical quantities measured and calculated during the experiment, the relationships between them, the methods used to obtain data, and the methods used to arrive at the final result, but does not tie them together in a coherent summary of the experiment.</p> <p>The abstract contains information peripheral to a summary of the experiment.</p> <p>The results of the experiment are stated but not placed in context with results from the professional literature.</p>	<p>The abstract fails to summarize the experiment. The abstract fails to include some of the physical quantities measured or calculated during the experiment, the relationships between them, the methods used to obtain data, or the methods used to arrive at the final result.</p> <p>The abstract contains such large gaps that the result of the experiment is neither plausible nor credible to the reader. ("I don't believe you.")</p> <p>The abstract fails to capture the interest of the reader.</p> <p>The results of the experiment are not stated and not placed in context with any other results.</p>	<p>The abstract contains false statements of such magnitude that the author has lost all credibility with the reader.</p> <p>The abstract fails to communicate anything essential about the experiment.</p> <p>The results of the experiment are not stated and not placed in context with any other results.</p>

## Introduction

A	B	C	D	F
<p>The introduction motivates the experiment and places it in a proper historical context.</p>	<p>The motivation for the experiment is sufficient but lacking import.</p> <p>The historical context is sufficient but brief.</p>	<p>The motivation for the experiment is weakly stated, incomplete, or imprecise.</p> <p>The historical context is incomplete or imprecise.</p>	<p>The motivation for the experiment is weak or glib.</p> <p>The historical context is muddled. (Historical facts are poorly stated, bordering on inaccurate, or the facts lack continuity.)</p>	<p>The motivation given for the experiment is incorrect, or no motivation is given for the experiment.</p> <p>Historical facts are inaccurate, or the experiment is not placed in a historical context.</p>

### Theory (General) and Theory (Specific to the Experiment)

A	B	C	D	F
<p>The author has expressed a sound conceptual understanding of the assumptions and the principles of physics underlying the experiment. Appeals are made to both the laws of physics and mathematics.</p> <p>Critical assumptions are stated clearly.</p> <p>The chain of logic is clearly laid out, taking the reader from the fundamental relationships between the physical quantities associated with the most common systems in physics, such as the simple harmonic oscillator, to the equations summarizing the relationships among the physical quantities to be obtained and the physical quantities to be measured during the experiment.</p> <p>Abstractions are substantiated with concrete details or examples (where it makes sense to do so).</p>	<p>The author has expressed an emerging understanding of the assumptions and the principles of physics underlying the experiment, usually characterized by explanations that are not succinct, incomplete explanations, or imprecise language. Appeals are frequently made to both the laws of physics and mathematics.</p> <p>Most of the critical assumptions are stated clearly.</p> <p>The chain of logic is laid out in an organized fashion. Minor gaps and errors in the chain of logic are overcome with little effort on the part of the reader.</p> <p>Abstractions are frequently substantiated with concrete details or examples.</p>	<p>The author has expressed a weak understanding of the assumptions and the principles of physics underlying the experiment, usually characterized by false statements or substantial omissions. Appeals are occasionally made to both the laws of physics and mathematics.</p> <p>Some of the critical assumptions are missing.</p> <p>The chain of logic is disorganized. Gaps and errors in the chain of logic require some effort on the part of the reader to overcome.</p> <p>Abstractions are only occasionally substantiated with concrete details or examples.</p>	<p>The author has mimicked the theoretical development laid out in the manual for the experiment or in another source. Appeals are rarely made to the laws of physics and mathematics.</p> <p>Most of the critical assumptions are missing.</p> <p>The chain of logic suffers from significant gaps and errors such that the reader must stop and do significant work to make sense of the paper.</p> <p>Abstractions are rarely substantiated with concrete details or examples.</p>	<p>The author has expressed multiple conceptual errors; many statements lack critical (substantive) details. No appeals are made to the laws of physics or mathematics.</p> <p>Critical assumptions are missing.</p> <p>The chain of logic is so incomplete that the author has lost all credibility with the reader.</p> <p>Abstractions are not substantiated with concrete details or examples.</p>

## Apparatus

A	B	C	D	F
<p>The description of the apparatus is accurate. The reader can reproduce the apparatus without error.</p> <p>The apparatus has been reduced to its principle forms.</p> <p>The words chosen to describe each part lead to a clear visual representation of that part in the mind of the reader.</p> <p>The physical and functional relationships between parts are clear.</p> <p>The description of the function of each part is well integrated with the design of the experiment.</p> <p>Systems are presented separately (e.g. mechanical vs. electrical).</p> <p>The description of the apparatus is well supported with one or more accurate depictions of the apparatus (figures) that assist the reader in visualizing the apparatus.</p>	<p>The reader can reproduce the apparatus without error with a little effort.</p>	<p>Only the experienced reader can reproduce the apparatus without error.</p> <p>The apparatus has not been reduced to its principle forms.</p> <p>The words chosen to describe each part do not always lead to a clear visual representation of that part in the mind of the reader.</p> <p>Some of the physical and functional relationships between parts are missing.</p> <p>The description of the function of each part tends to stand alone rather than be integrated with the design of the experiment.</p> <p>Systems are not presented separately (e.g. mechanical vs. electrical).</p> <p>The description of the apparatus is only weakly supported with one or more depictions of the apparatus.</p>	<p>The reader cannot reproduce the apparatus without doing significant work to make sense of its description.</p>	<p>The description of the apparatus is so incomplete, disorganized, or otherwise broken that the reader simply cannot visualize the apparatus, let alone reproduce it.</p>

## Procedure

A	B	C	D	F
<p>The description of events is clear, organized, and accurate. The procedure is reproducible.</p> <p>The procedure is well thought out, provides an adequate measurement of all uncertainties, and serves to limit all uncertainties.</p>	<p>The description of events lacks some organization. Errors and omissions are minor and infrequent; the reader can reproduce the experiment with a little effort.</p> <p>The procedure is well thought out and provides an adequate measurement of all uncertainties but does not limit all uncertainties.</p>	<p>The description of events lacks organization. Errors and omissions are minor but frequent; the reader can still reproduce the experiment with some effort.</p> <p>The procedure largely mimics that provided in the manual for the experiment.</p> <p>The procedure contains some arbitrary actions, indicating it was not well thought out.</p> <p>Increments are not randomized.</p> <p>The procedure does not result in an adequate measurement of all uncertainties and does not limit all uncertainties.</p>	<p>The description of events is poorly organized. Errors and omissions are significant. The reader must stop and do serious work to reproduce the experiment.</p> <p>The procedure is a copy of the procedure provided in the manual for the experiment.</p> <p>The procedure contains some arbitrary actions, indicating it was not well thought out.</p> <p>The procedure leads to significant underestimates or overestimates of some of the uncertainties.</p>	<p>The procedure is irreproducible from the description given.</p>

## Data Analysis

A	B	C	D	F
<p>All measured quantities (including those given by the manufacturer) are presented.</p> <p>Intermediate quantities, calculated from the measured quantities, are reported and integrated with the description of the data analysis.</p> <p>The description of the data analysis includes all mathematical operations on the data leading to the final result.</p> <p>The description of the data analysis is clear and accurate. The reader can readily reproduce the final result.</p> <p>The data analysis takes full advantage of all the available data.</p>	<p>All measured quantities (including those given by the manufacturer) are presented.</p> <p>Intermediate quantities, calculated from the measured quantities, are reported but are not necessarily integrated with the description of the data analysis.</p> <p>Errors and omissions are minor and infrequent. The reader can reproduce the final result with a little effort.</p> <p>The data analysis does not take full advantage of all the available data.</p>	<p>All measured quantities (including those given by the manufacturer) are presented.</p> <p>Some intermediate quantities are not reported.</p> <p>Errors and omissions are minor but frequent. The reader can still reproduce the final result with some effort.</p> <p>The data analysis relies on simplistic or naive methods to arrive at the final result.</p>	<p>Not all measured quantities are presented.</p> <p>Intermediate quantities are not reported.</p> <p>Errors and omissions are significant; the reader must stop and do serious work to reproduce the final result.</p> <p>The data analysis is flawed.</p>	<p>The reader cannot reproduce the final result.</p>

## Error Analysis

A	B	C	D	F
<p>All numerical values are stated with uncertainty, except where noted for good reason.</p> <p>The author has provided sufficient detail regarding the procedure and the data analysis that it is clear to the reader that all uncertainties are reasonable or correct.</p>	<p>One or two numerical values are stated without uncertainty, but the calculation of the uncertainty in the final result does not depend on these uncertainties.</p> <p>Otherwise, the uncertainties assigned to all of the measured quantities are reasonable, and all other uncertainties appear to be correct.</p> <p>The uncertainty in the final result is reasonable based on the uncertainties presented in the paper and the apparent scatter in the data.</p>	<p>One or two numerical values are stated without uncertainty, but the calculation of the uncertainty in the final result does not depend on these uncertainties.</p> <p>One of the following applies: The uncertainties assigned to some of the measured quantities are suspect, the calculated uncertainties are suspect, or the uncertainty in the final result is suspect.</p>	<p>One or two numerical values are stated without uncertainty.</p> <p>The calculation of the uncertainty in the final result depends on the uncertainties omitted; therefore, the uncertainty in the final result is suspect, if not incorrect.</p> <p>The ability of the author to estimate uncertainties, calculate uncertainties, account for them, and propagate them through calculations is suspect.</p>	<p>Multiple numerical values are stated without uncertainty.</p> <p>The stated uncertainties on measured quantities are clearly unreasonable.</p> <p>Calculated uncertainties are clearly incorrect.</p> <p>The author has lost all credibility on account of these errors.</p>

## Conclusion

A	B	C	D	F
<p>The author has stated clearly the final results of the experiment and has placed it in context with at least one result the professional (peer-reviewed) literature.</p> <p>The author has adequately addressed or explained any discrepancies in the data or the uncertainties.</p> <p>The author has correctly identified the measured quantity with the largest fractional uncertainty.</p> <p>The author has made one or more insightful or novel suggestions for improvements to the experiment, indicating a deep understanding of the design of the experiment, the equipment used to conduct the experiment, and the relative uncertainties in the data.</p>	<p>The author has stated clearly the final results of the experiment and has placed it in context with at least one result from the professional (peer-reviewed) literature.</p> <p>The author has commented on any discrepancies in the data or the uncertainties but has not offered an adequate explanation for them.</p> <p>The author has correctly identified the measured quantity with the largest fractional uncertainty.</p> <p>The author has made one or more modest suggestions for improvements to the experiment, characteristic of an emerging understanding of the design of the experiment, the equipment used to conduct the experiment, and the relative uncertainties in the data.</p>	<p>The author has stated the final result of the experiment and has placed it in context with at least one result from the professional (peer-reviewed) literature.</p> <p>The author has overlooked some telling aspects of the data and/or uncertainties.</p> <p>The author has correctly identified the measured quantity with the largest fractional uncertainty.</p> <p>The author has made only glib suggestions for improvements to the experiment.</p>	<p>The author has stated the final result of the experiment but has not placed it in context with at least one result from the professional (peer-reviewed) literature.</p> <p>The author has overlooked some telling aspects of the data and/or uncertainties.</p> <p>The author has not correctly identified the measured quantity with the largest fractional uncertainty.</p> <p>Suggestions for improvements to the experiment indicate a weak or faulty understanding of the design of the experiment or would not in fact serve to improve the experiment.</p>	<p>The author has not stated the final result of the experiment.</p> <p>The author has failed to notice obvious discrepancies or inconsistencies in the data.</p> <p>The author has not correctly identified the measured quantity with the largest fractional uncertainty.</p> <p>The author has made no suggestions for improvements to the experiment.</p>

## References

A	B	C	D	F
References to the professional literature appear at all critical points in the paper. References are relevant and substantive.	References to the professional literature appear at all critical points in the paper but some are not relevant or substantive.	References to the professional literature are lacking at critical points in paper.	References to the professional literature are lacking at critical points in paper. Some references are not authoritative.	The paper contains no references to the professional literature.

## Equations

A	B	C	D	F
<p>Equations are justified; the relationships between physical quantities are tied to the principles of physics and mathematics.</p> <p>The relationships between physical quantities are described in the text; equations complement the text.</p> <p>All variables are defined in the text.</p>	<p>Most equations are justified; the relationships between physical quantities are tied to the principles of physics and mathematics.</p> <p>The relationships between physical quantities are described in the text; equations summarize these statements.</p> <p>All variables are defined in the text.</p>	<p>Most equations are presented without justification.</p> <p>The relationships between physical quantities are left to equations rather than described in the text.</p> <p>All variables are defined in the text.</p>	<p>Most equations are presented without justification.</p> <p>Equations are translated literally.</p> <p>Not all variables are defined in the text.</p>	<p>One or more equations are incorrect as stated.</p>

## Tables

A	B	C	D	F
<p>Tables are easy to read. Numerical values can be compared to one another quickly and easily. Critical numerical values can be ascertained quickly.</p> <p>Data appear in a meaningful order.</p> <p>Tables represent the data accurately.</p> <p>Table captions are succinct and meaningful. Tables can be interpreted independent of the paper.</p> <p>Tables deftly support the text.</p>	<p>Subtle changes to the layout of the tables would make them easier to read.</p> <p>Data appear in a meaningful order.</p> <p>Tables represent the data accurately.</p> <p>Table captions are succinct and meaningful, but tables cannot be interpreted independent of the paper. (For example, variables in the table header are not defined.)</p> <p>Tables adequately support the text.</p>	<p>Minor changes to the layout of the tables would make them easier to read.</p> <p>Data appear in no meaningful order.</p> <p>Tables misrepresent some of the data.</p> <p>Errors or omissions are apparent but have no significant impact on the interpretation of the data.</p> <p>Tables contain some irrelevant data, data that could be omitted, or data that could otherwise be placed in the text.</p> <p>Table captions are rudimentary.</p> <p>Tables are used in place of text.</p>	<p>Tables are convoluted and difficult to read.</p> <p>Data appear in no meaningful order.</p> <p>Tables misrepresent some of the data.</p> <p>Errors or omissions significantly impact the interpretation of the data.</p> <p>Tables contain distracting, irrelevant data.</p> <p>Table captions are vague or repeat the header content.</p> <p>Tables bear little to no relationship to the text.</p>	<p>Tables are so poorly organized, or the errors or omissions are so severe, that the reader cannot make sense of the data.</p>

## Figures

A	B	C	D	F
<p>Figures are easy to interpret (all of the elements are labeled; no elements overlap; size, shading, and color are used deftly to distinguish the elements in a figure from one another, etc.).</p> <p>Figures are complete (no missing elements).</p> <p>Figures accurately depict the relationships between elements.</p> <p>Figure captions are succinct and meaningful. Figures can be interpreted independent of the paper.</p> <p>Figures deftly support the text.</p>	<p>Subtle changes to the layout of the figures would make them easier to interpret.</p> <p>Figures are complete (no missing elements).</p> <p>Figures accurately depict the relationships between elements.</p> <p>Figure captions are succinct and meaningful, but the figures cannot be interpreted independent of the paper.</p> <p>Figures adequately support the text.</p>	<p>Minor changes to the layout of the figures would make them easier to interpret.</p> <p>Errors and omissions have no significant impact on the interpretation of the figure.</p> <p>Figures do not accurately depict the relationships between elements.</p> <p>Figures contain irrelevant elements.</p> <p>Figure captions are rudimentary.</p> <p>Figures used in place of text rather than in support of the text.</p>	<p>Figures are difficult to interpret.</p> <p>Errors and omissions are significant and impact the interpretation of the figure.</p> <p>The relationships between elements cannot be ascertained from the figure.</p> <p>Figures contain irrelevant elements.</p> <p>Figure captions are vague or repeat the content of the figure.</p> <p>Figures bear little to no relationship to the text.</p>	<p>Figures are so poorly organized, or the errors and omissions are so severe, that the reader cannot make sense of them.</p>

## Graphs

A	B	C	D	F
<p>Graphs are easy to interpret. Data points can be compared to one another quickly and easily. Critical data points can be found quickly.</p> <p>Graphs accurately represent the relationships between variables.</p> <p>Captions are succinct and meaningful. Graphs can be interpreted independent of the paper.</p> <p>Graphs deftly support the text.</p>	<p>Subtle changes to the layout of the graphs would make them easier to interpret.</p> <p>Graphs accurately represent the relationships between variables.</p> <p>Captions are succinct and meaningful, but the graphs cannot be interpreted independent of the paper.</p> <p>Graphs adequately support the text.</p>	<p>Minor changes to the layout of the graphs would make them easier to interpret.</p> <p>Graphs do not accurately represent the relationships between variables</p> <p>Errors or omissions have no significant impact on the interpretation of the data.</p> <p>Graphs contain irrelevant data or information that should be placed in the caption or the text by convention.</p> <p>Captions are rudimentary.</p> <p>Graphs used in place of text.</p>	<p>Graphs are convoluted and difficult to read.</p> <p>Graphs do not accurately represent the relationships between variables.</p> <p>Errors and omissions are significant and impact the interpretation of the data.</p> <p>Graphs contain irrelevant data or information that should be placed in the caption or the text by convention.</p> <p>Captions are vague or repeat the content of the graph.</p> <p>Graphs bear little to no relationship to the text.</p>	<p>Graphs are so poorly organized, or the errors or omissions are so severe, that the reader cannot make sense of the data.</p> <p>Graphs are not useful in the analysis of the data.</p>

## Quality of Writing

A	B	C	D	F
<p>Sharp focus, coherent structure. Abstractions substantiated with aptly chosen and deftly integrated concrete details. Error-free prose. Complex, grammatical structures used effectively to achieve rhetorical goal.</p>	<p>Organized, sensible content. Abstractions balanced with clarifying details. Nearly error-free prose. A variety of grammatical structures used to achieve rhetorical goal.</p>	<p>Sensible content, but lacking some organization. Abstractions usually balanced with clarifying details. Grammatical, punctuation, and spelling errors are apparent but only occasionally distracting.</p>	<p>Content ranges from the barren to the superficial. Lacks structure, organization, focus. Abstractions lack clarifying details. Prose littered with convoluted sentences, run-on sentences, and/or sentence fragments. Grammatical, punctuation, and spelling errors are frequent and distracting.</p>	<p>The grammar and language structures are so particularly bad that most sentences are reduced to gibberish when taken literally.</p>