

## Rubric – Personal Section

Tuesday, June 19, 2018 3:22 PM

<b>PERSONAL NOTEBOOK RUBRIC (65 PTS)</b>	<b>/65</b>
<b>DATA ANALYSIS</b>	<b>/25</b>
<p><b><u>Final Analysis of data (10 pts)</u></b>  <b>All data</b> taken are <b>analyzed</b>.  Analysis of data is <b>correct</b>.  <b>Plotting and fitting</b> of data to obtain results <b>is used</b> when appropriate.  <b>All calculations</b> performed, in whatever manner (spreadsheets, code, by hand), are <b>fully</b> and <b>clearly</b> described with annotations.  <b>Computer code</b> (Python, Matlab, Mathematica, etc.) or spreadsheets, if used, is printed out and included.  <b>Spreadsheet</b> printouts are <b>clearly laid out</b>: they would make sense to other students in the course. Columns and rows are labeled with quantities and units.  <b>Formulas</b> used are <b>written</b> near relevant parts of the report. <b>Variables</b> are either <b>obvious</b> (e.g., standard constants) or <b>defined</b>.</p>	<b>/15</b>
<p><b><u>Graphs (5 pts)</u></b>  <b>Graphs are easy to read</b>: one could estimate data points from the graph itself.  <b>Graphs follow basic formatting conventions</b>:</p> <ul style="list-style-type: none"> <li>Legends are given for graphs with multiple data sets and/or curves</li> <li>Data points are bare—point symbols not connected with lines</li> <li>When applicable points include error bars</li> <li>Theoretical curves and/or fits are shown as lines (not points).</li> <li>Axes are labeled with quantity and correct units, and each graph is titled.</li> </ul>	<b>/5</b>
<p><b><u>Uncertainty analysis and calculation (10 pts)</u></b>  <b>Statistical uncertainty is calculated</b> for numerical results.  <b>Reasoning</b> and method used to derive uncertainty in final results is clearly presented.  Calculations are <b>correct</b> and <b>clearly shown</b> (either in entirety or with examples).  Dominant sources of <b>systematic uncertainty</b> and their possible effect on the results <b>are described</b> in the notes.</p>	<b>/10</b>
<b>EXERCISES and QUESTIONS</b>	<b>/8</b>
<p><b><u>Solutions to exercises (8 pts)</u></b>  <b>Solutions to all exercises are present and correct</b>.  Exercises are <b>commented on</b>: significance to experiment is discussed.</p>	<b>/8</b>
<b>DATA DISCUSSION</b>	<b>/7</b>
<p><b><u>Assessment and presentation of final results (7 pts):</u></b>  <b>Numerical results</b> are stated with correct <b>format, units, significant digits</b> and <b>uncertainty</b>.  Final results are <b>critically evaluated</b> within the notes: e.g., different results are compared to each other, noting trends or patterns; results are compared to literature or expected values and agreement is discussed.  <b>Sources for literature values</b> are cited in <b>sufficient detail</b>.</p>	<b>/7</b>

<b>SUMMARY AND ERROR DISCUSSION</b>	/25
Part 1: Summary Abstract(1 page)	/15
<b>General (4)</b> <i>Overall, it is <b>clear</b> that the writer <b>understands the experiment</b>.</i> <i>Writing is clear and logically structured.</i> <b>English is correct</b> in terms of spelling, grammar, word choice and usage. <b>Style</b> of writing follows conventions appropriate to a scientific journal.	/4
<b>First paragraph - Statement of purpose (3)</b> <i>First sentence (or two) states the <b>purpose</b> of the experiment in a <b>general way</b>.</i> <i>The statement of purpose <b>highlights the essential physics</b> studied by the experiment.</i> <i>The statement of purpose <b>names the central technique</b> used in the experiment (e.g., laser saturation spectroscopy, pulsed nuclear magnetic resonance).</i> The statement is <b>clear</b> , i.e. it would be easily understood to other students in the course. Phrases such as "The purpose of this experiment...", or "In this lab, we..." are avoided	/3
<b>Second paragraph - Method (3)</b> <i>The method is described in a <b>general way</b>.</i> <i>The description <b>clearly indicates the chain of cause and effect</b>: how the experiment works.</i> <b>Trivial details</b> that have no bearing on the interpretation of the results <b>are omitted</b> . <b>Important conditions</b> that would affect the interpretation and understanding of the results <b>are included</b> .	/3
<b>Third paragraph - Results (2)</b> <i>The statement of results is <b>complete</b>.</i> <i>The statement of results is <b>correct</b>.</i> Numerical results are presented with correct <b>units, format, significant digits</b> and <b>uncertainty</b> . Graphical or tabular results <b>follow the criteria given in the notebook rubrics</b> .	/2
<b>Final paragraph(s) - Assessment/Discussion (3)</b> <i>The discussion is <b>complete</b>: all results are assessed in sufficient depth.</i> <i>The discussion is <b>correct</b>: arguments made are based on sound physical reasoning.</i> <i>When possible, results are <b>compared to literature</b>.</i> <b>Different results</b> within the experiment are <b>compared to each other and interpreted</b> . The discussion would be <b>easily understood</b> by other students in the course. <b>Literature</b> comparisons are made <b>correctly</b> . If they exist, <b>trends or patterns in the results</b> are adequately <b>noted</b> and <b>interpreted</b> . The <b>dominant source of uncertainty</b> , random or systematic, is adequately <b>noted</b> and <b>described</b> .	/3
Part 2: Discussion of Uncertainty (1/2-1 page)	/10
<b>General (3)</b> A good, clear discussion is one that states the uncertainty in the important quantities numerically. The most important contributions to the calculated uncertainties are listed with reasons for why they contribute the stated amounts. Consideration is given to how the dominant source(s) might be reduced further or characterized better.	/3
<b>Uncertainty Discussion: Statistical Uncertainty (3)</b> The uncertainty discussion is consistent with the data and analysis portion of the report; no new sources of uncertainty are introduced in the discussion; all effects should have already been assessed in the notebook (1 pt). All important contributions to random uncertainty	/3

are identified and evaluated: The writer has included the major sources of the random uncertainty in the discussion and identified the biggest contributor to the random uncertainty, along with perhaps a couple of other lesser contributors. The source of an uncertainty is the reason that a contributor has the uncertainty that it does (2 pts).

**Systematic error (4)**

The discussion correctly distinguishes between systematic and random uncertainty. (1 pt)  
All important contributions to systematic uncertainty are identified and evaluated: Effort must be made to identify source of systematic uncertainty. Such sources should be supported by a believable physical mechanism, for example an imperfection with the measurement procedure, apparatus, method of data analysis, or a theoretical model that is insufficiently complete. When possible, an attempt must be made to quantitatively describe how much a particular change in the cause would affect the results of the experiment. The size of the systematic uncertainties should be compared with those of the random contributions. Any unexpected trends or anomalies in the data or results should be discussed. When possible, comparisons to values in the literature must be made, and the level of agreement or disagreement evaluated.

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