Chemistry lab conclusion example

Temperature and pressure measurements of an ideal gas that is heated in a closed container Introduction This report discusses an experiment to study the temperature and pressure relationship of an ideal gas (air), which was heated in a closed container. Because the ideal gas was in a closed container, its volume remained constant. The objective of the experiment is to test whether the ideal state equation holds. In the equation, $pV = mRT$, where p is the gas pressure, V is the volume, m is the mass, R is a constant, and T is the temperature. This report presents the procedures for the experiment, the results of the experiment and an analysis of these results. Procedures In this experiment, the air (an ideal gas) was heated in a pressure vessel with a volume of 1 liter. On this pressure vessel there was a pressure transducer and thermocouple to measure the pressure and air temperature inside the vessel, respectively. Both transducers produced voltage signals (in Volts) that were calibrated to the pressure (kPa) and the air temperature (K) (atmospheric pressure for the place where the experiment took place is assumed to be 13,6 psia). In addition, the theoretical air temperature (K) was calculated according to the values measured under pressure (kPa). Results and discussions This section analyzes the results of the experiment. The experiment went as expected, without unusual events that would have introduced error. The voltages measured for pressure and temperature transducers appear in Table A-1 of the Appendix. Equations used to calibrate these voltages with actual pressures and temperatures are also included in the appendix. These equations led to the pressure and temperature values that are displayed in the third and fourth columns of Table A-1. From these values, a graph was created between temperature (K) and pressure (kPa) (Figure A-1). After it can be seen from the graph, the relationship between temperature and pressure is approximately linear. As part of this experiment, theoretical temperature values were calculated for each measured pressure value. In this calculation, which used the ideal gas equation, volume and mass were considered constant. These theoretical temperature values are indicated in the final column of Table A-1. From this final column appeared Figure A-2, a graph of ideal temperature (K) versus pressure (kPa). After it is shown in this graph, the relationship between temperature and pressure is exactly linear. A comparison between the graph showing the measured data (Figure A-1) and the graph showing theoretical data (Figure A-2) indicates differences. In general, the measured temperature values are lower than the ideal values, and the measured values are not exactly linear. Several errors could explain the differences: precision errors in the transducer pressure and thermocouple; bias errors in the curve for the pressure transducer and thermocouple; and imprecision in the atmospheric pressure assumed for the local. Bias errors may occur from the high temperature range considered. Since the temperature and pressure ranges are high, the calibration equations between voltage signals and actual temperatures and pressures may not be accurate for the entire range. The last type of error mentioned, the error in the atmospheric error for the locality where the experiment took place, is a bias error that could be quite significant, depending on the difference in conditions between the time of the experiment and the time at which the reference measurement was carried out. Conclusion In general, the experiment managed to show that the temperature and pressure for an ideal gas at constant volume and mass follows the relationship between the ideal gas equation. There were differences in the experimental temperature graph versus pressure and in the theoretical temperature versus pressure curve. However, these differences can be accounted for by experimental errors. Appendix: Experimental data and plots This appendix presents the data, calculations and graphs in the experiment to verify the ideal gas equation. The first two columns in Table A-1 show the voltages measured from the pressure transducer and the temperature transducer. Column three shows the measured pressure values calculated from the following calibration curve for the pressure transducer: $p = 4,3087(V \cdot V) - 13,1176V + 10,7276$ where V is equal to the output of the voltage (volts) from the pressure transducer, and p equals the absolute pressure (kPa). Column four shows the measured temperature values (K) calculated from the calibration curve for the thermocouple: $T = T_{ref} + V/S$ where Tref is equal to the reference temperature of the ice bath (0°C), V is equal to the voltage (volts) measured on the thermocouple pair, and S equals the thermocouple constant, 42.4 μV/°C. Finally, column 5 presents the ideal temperature values for the corresponding measured pressure values. These ideal values arise from the ideal gas equation ($PV=mrt$). Figure A-1 shows the temperature graph (K) versus pressure (kPa) for the measured case. Figure A-2 shows the temperature versus pressure graph for the ideal case. Table A-1. Data From Experiment Voltagepres (V) Voltagetemp (V) Pressuremeas (kPa) Temperatures (K) Temperatureideal (K) 6.32 0.0011 99.90 298.94 312.17 6.39 0.0020 102.81 320.32 321.28 6.78 0.0031 119.82 346.26 374.44 7.31 0.0046 145.04 381.64 453.24 7.17 0.0052 138.14 395.79 431.69 7.35 0.00 64 147.04 424.09 459.50 7.45 0.0073 152.11 445.32 475.32 7.56 0.0078 157.78 457.11 493.04 7.66 0.0097 163.02 501.92 509.43 8.06 0.0107 184.86 525.51 577.69 8.10 0.0114 187.12 542.02 584.75 8.34 0.0130 200.97 579.75 Figure

A-1. Temperature versus pressure, measured by the transducers. Figure A-2. A-2. calculated from the ideal gas equation. Laboratory report1,2 Authors: M.C. Nagan and J.M. McCormick Introduction Research work is the main means of communication in science. The research paper presents the results of the experiment and the interpretation of the data, describes the reason and design of the experiment, provides a context for the results in terms of previous findings and evaluates the overall success of the experiment (experiments). Scientists working in industrial laboratories don't write as many journal articles as their academic colleagues, but they typically write progress reports that take the same form as a journal article. So no matter what your career goals are, it's important to familiarize yourself with this style of writing. There are established rules for preparing a journal article (or lab report). Style requirements vary only slightly from one journal to another, but there are many more similarities than differences in the style of scientific writing. If you write an article for publication in a particular journal (or prepare a lab report in the style of a particular journal), you should see the Authors' Instructions section of the magazine's website (this information is also included in the first issue of the magazine each year). There are several style guides3,4 and articles5 to help scientists and students prepare their manuscripts. The most useful of these for chemists is the American Chemical Society's (ACS) ACS Style Guide, which can be found in the Truman library or purchased from the ACS website. Due to the variation in log styles and requirements for a particular course, the instructor will inform you of the specific style requirements for his class. This guide is based on the Journal of American Chemical Society Style,6 and is meant to provide a good starting point for writing a laboratory report. It is not meant to be the definitive style guide; you need to adjust your style to the audience and the log where the results will be published. General editorial problems Although we shouldn't, we're all influenced by first impressions. The way your work appears for the journal editor or reviewer is their first impression of your science, and will color their impression of your results if you left it. Nothing is worse than a sloppily prepared paper without page numbers, a font that cannot be read or that is full of grammatical errors. Remember that everyone will assume that if you haven't taken the time to write the paper carefully, you haven't taken the time to do science carefully. The following are some general editorial guidelines to follow, which will leave a good first impression with readers 1) Double-space paper throughout (including figure captions and tables, too). 2) Use a font of reasonable size, it would 12 times. 3) For figures, you can choose to use a sans-serif font for better graphics quality, such as Arial or Helvetica. 4) Use at least 1 edges on all sides. 5) Number of pages. Place page numbers in the upper-right corner or right-hand corner or centered at the bottom of the page. Any of the styles is acceptable and any of the ones you choose remain consistent in the numbering scheme throughout the paper. 6) Do not start sentences with symbols or numbers; rather, write the full name of the symbol if it is used at the beginning of the sentence. For example, write Alpha-lactalbumin instead of α-Lactalbumin when a sentence begins. Also, specify the symbols or numbers in a title, unless part of a chemical name (e.g. 2-hexanol). 7) Check the document thoroughly. Have someone who will give you an honest and complete critique of your paper, read the newspaper. Review, review, review! General stylistic problems The uniformity of style is the key to scientific communication. The editors of the magazine, the reviewers who review a manuscript and the readers of the magazine who are interested in the results presented in a paper expect certain things to be present in a manuscript and be in a certain order. Like sloppy-looking paper, a work that does not adhere to the expected style reflects poorly on the author, no matter how good science is. 1) The work should be written in a third person, passive voice. Occasionally, but rarely, it is necessary to use new when describing the intention of the authors. It generally depends on the intended subject-matter of the penalty. Consider the two sentences below: a) Solid calcium (5 g) has been poured into a glass. b) I poured solid calcium (5 g) into a glass. In the first sentence (a), which is passive, the subject is calcium solid. In the second sentence, the subject is the experimenters. In scientific articles, the subject is most often science and not experimenters. 2) Use past time in general (for example, what was or was done). However, use the present time when describing the properties of molecules or organisms because they still have these properties. 3) Unless directed otherwise, assume the reader's lab report is your peer, average chemistry student, not chemistry teacher. Therefore, everything should be explained as if the reader knows some chemistry, but is not an expert in the subject of paper. By no means do the reader know what you are doing, or why you are conducting your experiment. Think about what you would like to know about this topic, if you have been a reader. 4) Avoid repetition in language. Try not to start each sentence the same construction and words. 5) Do not use quotation marks. Unlike humanities or literature, quotations are rarely found in scientific articles. However, it is is to paraphrase other authors. 6) Explain the technical terms. Example Hemoglobin has a Hill constant, a value that describes the degree of cooperative ligand binding, of 2.8. 7) Definition of abbreviations. Example The official colors of Truman State University (TSU) are purple and white. 8) Place a space between a number and a unit. Example Sephadex (10 g) was combined with H_2O deionized (100 ml) at 25 °C. 9) Do not start a sentence with a number or Figure 1 or Table 1, etc. Correct: Milk samples (50 μL) were analysed by high-performance liquid chromatography under three different buffer conditions (Figure 1). Incorrect: Figure 1 shows high-performance liquid chromatography chromatograms for the sample running under three different buffer conditions. Incorrect: 50 μL of milk was analysed by high-performance liquid chromatography using three different buffer conditions. 10) There are three ways to refer to a work in the text. For example, the citation of the work written by Jackson, A. K.; Wilson, R.S.; Houk, K. L.*, could appear in the text in any of the following ways. (Note that et al. is an abbreviation for et alia and that it is italic because it is not English.7) a) Jackson et al.b) Jackson and colleagues c) Houk and colleagues In the last example we assumed that the author whose name is played is principle investigator on the project, and gave them more credit for the job. Note that it is an American convention to list the investigators principle last, while many European and Japanese magazines place them first. There are often two main investigators, and in this case both should be mentioned. For example, the work of Jackson, A. K.; Wilson, R.S.*; Houk, K. L.* should be mentioned, in the format given in example (c) above, such as Wilson, Houk and colleagues. Where there are more than two principal investigators, it is best to use any of the formats referred to in (a) or (b) or to use another form to avoid this construction in its entirety. Sections of the organization/components must appear in your work in the order described below. All sections with which the title is located have the section explicitly labeled, usually in bold, to differentiate it from the rest of the text and left-aligned on the page. A blank line should appear after the last word of the section to separate the different sections, but a line should not be placed after the section title. 1) Title/Title page 2) Summary 3) Introduction 4) Experimental (Materials and methods in some journals) 5) Results 6) Discussion 7) Conclusions 8) Confirmations 9) References 10) Tables 11) Schemes 12) Figure Legends 13) Figure 14) Supporting information Please note that you do not have to physically assemble the work in this order. Instead, it is compose: a) Materials and methods, b) Figures, Legends figures and tables, c) c) d) Discussion, e) Conclusions, f) Introduction and schemes, g) Summary, and h) Title. Then put all sections together in the final paper in the order above. A template is available to help you organize your report. Click here to learn more about it. These subsections should have their own titles which are Italian and followed by a period. Description of the title/title of paper components A title reflects the focus and content of the work. It tells the reader the subject of the paper and also annuies the reader to continue to read further. Therefore, it is not unusual for the title to reveal the major results or conclusions of the experiment. The examples are given below. The title must be on its own page (title page), left-aligned at the top of the page, in bold. Note that in some journals the font size of the title is 2 points larger than the text (for example, 14 points if the rest of the paper is in a standard 12-point font). However, this is not standardized and you should check with the instructor for whom the format he/she wants to follow. The title must be short (maximum 2 lines) and grammatically correct. Under the title, write your name and professional address in cursive (Department of Chemistry, Truman State University, 100 East Normal, Kirksville, MO 63501). Example of titles 1) Determination of the differential fluidity of water and benzene by viscosity measurements 2) Alpha-lactalbumin purification from bovine skimmed milk by affinity chromatography of immobilized metal ions 3) Synthesis and characterisation of potassium(oxalato)ferrat(III) 4) Ionic composition of drinking water influenced by pipe materials: A spectroscopic analysis of atomic absorption Abstract Summary is a one-paragraph summary of the paper that is currently being written. Since the abstract is the only part of the work that is entered into the article databases, you should be able to stand alone, separate from the paper. The first to three sentences of the abstract should briefly introduce the reader to the problem studied. The scientific approach, the major results and the primary significance of the findings should be presented below. The abstract is generally 150-200 words (less for shorter works). This section is normally written after the body of the paper. Because the summary is separate from the paper, all abbreviations should be written or defined, and any references should be written in full. An example of how a reference might appear in an abstract is inhaled smoke from permanent markers have been shown to cause brain damage (Johnson, A.J. permanent markers and brain. J. Mr. Brain. Res. 2004, 18, 215–218). Note that in some journals that the inclusion of the title in a reference is not required (infra vacuum). Introduction Introduction should present the scientific issue at hand to the reader. Explain to the reader why the experiment was conducted, it was designed, and perhaps, if necessary, what was found. Relevant literature should be embedded and will help the reader understand the context of your study. A good rule of thumb is to start from the most general topic and gradually move towards specific. Here is a general outline for an introduction: I. The broad meaning of the subject to chemistry discipline and society in general, II. Introduction to the subject in Chemistry III. Description of the specific problem IV. General objectives and significance of the experiment or research subject In this section, consider including the figures, schemes and equations that complement the text. Although this is similar to the information you should have written to the notebook, the entry in a job is different from the background you included for an experiment (or experiments) in your notebook. Remember that you are trying to reach a larger, more general audience with your work, and the introduction needs to be structured to draw the reader in and help them focus on important results. Experimental The experimental section of your work must be a logical and coherent recount of the experiment(s). This section should be complete enough for a trained scientist to pick up your report and replicate the experiment. The experimental section of a laboratory report is more concise than the corresponding section of the laboratory notebook. This should not be a step-by-step procedure for activities carried out during the laboratory period. The first paragraph of the experimental section shall contain information on the key chemicals used in the procedure. When chemicals are used so have been received, there will usually be a statement to this effect and usually no further details are required. You will list the name of the chemical supplier and the purity of the substance will be observed in cases where the chemical is difficult to find, is of a special purity or if there is only one supplier. Do not list lot numbers. Where a starting material has been synthesized in accordance with a literature procedure, this shall then be specified in the opening paragraph and reference shall be made to the procedure. If it is necessary to purify or dry the compounds, it is described here as well. The first paragraph will often also list the tools used to characterise newly synthesized substances. All instruments and equipment must be specified, including the instrument model number and the manufacturer's name (the not included). When a spectroscopic or physical method is the focal point of the report, it will be described in its own subsection. You are not asked to write experimental in this way. For common techniques, reference should be made to laboratory manuals. However, if a the published procedure has been amended, then this is declared and only the changes made are included. If the procedure is yours, then outline the procedure with the main points, including details that are critical to the reproduction of the experiment. These may include the type and size of the HPLC column, the buffer or concentrations of chemicals. When the synthesis of substances is reported, the synthetic procedure used to make each substance shall be described in its own separate paragraph. The paragraph begins with the name of the substance or its abbreviation (if the abbreviation was defined earlier in the work), in bold. If the numbers are assigned to the compounds, they are also included (in parentheses). Often the synthesis will be written, even when a literature procedure has been followed. Mass yields and percentages must be reported. Some of the characteristics of the new compound are included at the end of the paragraph describing its synthesis. These include: melting point range (and literature value, if known), elementary analysis (both calculated and found), selected mass spectrum peaks (with attributions), selected IR peaks (also with attributions) and any MRI peaks with their chemical displacement, multiplicity and integration (you will often find the observed coupling quoted and the attribution of the peaks). The following is an example of reporting the synthesis of a compound. Tris-(2-pyridylmethyl)amine: To a shaken solution containing 10,11 g chloride hydrochloride of 2 pyritilmethyl and 3,20 ml 2-pyridylmethyl amine in 20 ml H_2O has been added in a slow, drop (~1 drop every 25 sec) a solution containing 5.03 g NaOH in 12 ml H_2O, so that the whole solution was added in about 1.5 hours. After the complete addition of NaOH, the reaction mixture was heated on a heating mantle to 70 °C for 20 minutes. The cooled reaction mixture was then extracted four times with 50 ml CH_2Cl_2. The combined extracts were dried over Na_2SO_4 and CH_2Cl_2 was removed using a rotary evaporator. The resulting red oil solidified in the legs. The red solid was then dissolved in a minimum of hot hexane. The yellow solution was decanted from a red oil that did not dissolve and filtered hot. When cooled, the product crystallizes into large needles, which have been filtered and air-dried. Recrystallization from hexane gave 2.08 g of product (23% yield). The melting point of the product is 85 °C, sharp (specialist literature 87 – 89 °C).ref 1H MRI ($CDCl_3$, ppm): 3.89 (s, 6 H, methylene), 7.14 (m, J = 1.3, 6.1 Hz, 3 H, pyridil), 7.58 (d, J = 7.8 Hz, 3 H, pyridil), 7.63 (m, J = 1.8, 7.6 Hz, 3 H, pyridil), 8.15 (m, J = 0.9, 4.9 Hz, 6 H, piridil). 13C MRI ($CDCl_3$, ppm): 60.13 (methylene), 122.01, 136.48, 149.06, 159.25 (pyridil). The experimental section has two strange wrinkles on the general scientific style. These are: 1) when previously quoting procedures, the authors' names are not generally included, Correct Purification isolated bovine brain was performed in accordance with previously published procedures.ref Incorrect procedure previously published by Jackson et al.ref was followed with the changes presented below. 2) when quoting the use of a kit, pre-packaged test or other commercial equipment with directions, include only the company name in parentheses; should not be a complete reference. Example The Bradford (Sigma) test was performed to determine the total protein concentration of the five protein isolates. Results In the Results section, results are presented and summarized in a reader-friendly form. The raw data is not shown here. For example, it is necessary to include the calculated average concentration of a solution, but not the initial absorption values that were collected from the spectrophotometer; that the information is best left in the lab notebook. Charts and tables often make data easier to interpret and understand (click here to review chart preparation). A graph is presented in the paper as a figure. In general, a graph or table is an appropriate representation of data when more than 2 or 3 numbers are presented. Data that is presented in the form of a graph or table should be mentioned, but should not be repeated verbatim in the text, as this defeats the purpose of a graph. More information about figures and tables is presented later. The Results section also reports comparable literature values for properties obtained and/or calculated in the paper. Observation of trends in numerical data is acceptable. However, trend interpretation should be saved for the Discussion section. Remember, don't just report the numerical results. The Results section must have a narrative describing the results. This narrative may include a description of the data (such as spectra or data from the graphs), what problems were encountered during the acquisition of the data (and how it was resolved or not) and a general description of how the raw data was processed to give the final results (not a step-by-step description of everything you did). The reader wants to know what you did, you did it, what problems you encountered and finally what the results were. Each of these topics should be addressed in the Results section in a clear but concise way. Discussion This is the section where the results are interpreted. This section of the paper is similar to a debate. You must present your data, convince the reader of the reliability of your data and provide evidence for your beliefs. First Data. Do you have good, mediocre, terrible or uninterpretable data? Evaluate your results by comparing your values with the values in literature or other precedents. Explain what results should have been achieved and you have achieved these expected values. Note that even if the expected results were not achieved, you failed. Unexpected results are often the most interesting. Maybe your hypothesis wasn't correct. Why is that? What new hypothesis does your data suggest? If you think the results are unreliable, you need to explain why. Use statistical analysis or chemical principles to support your claims. Was there a systematic error? Is the error caused by the limitations of your device? Does the data look the same in a standard deviation? Evaluate the statistical significance of your data (click here to review the statistical treatment of the data). After validating the data, you must interpret the results; state what you think your results mean. help us understand the scientific problem? What do your results mean in the context of the overall picture of chemistry, or science? report your results to the concepts presented in the introduction? Do not assume that the experiment failed or was successful. You must prove to the reader, with logical arguments and supporting evidence, the value of your study. The conclusions you have written in your lab notebook are a good starting point from which to organize your thoughts. The discussion section of the paper is structured very similar to the conclusions section of your notebook, and it might be a good idea to review that now (click here to review the structure of the conclusions in your lab notebook). Conclusions The Conclusions section is usually a one-paragraph summary of the laboratory report. Here you summarize the objectives of the experiment, specify whether you have achieved this goal, and briefly describe the implications of the study. Note that in some sub-discipline chemistry it is acceptable to combine discussions and conclusions sections. Check the course syllabus or check with the instructor on the specific format to be used in your class. Confirmations Confirmations Section is where we thank everyone who has helped you significantly with the project or manuscript. For example, you would thank your lab partners if they are not paper authors, anyone who helped design the experiment or prepare the work. It could also include sources of funding, such as a Truman State University summer scholarship or a National Institutes of Health grant. Most of the ideas presented in your paper are probably not exclusive to yours. Therefore, you should quote other people's work whenever appropriate. However, you do not need to quote information that is common knowledge or is exclusively your idea. The References section is a compilation of all quotes made in the work. Not a bibliography and therefore should not list sources that are not directly mentioned in the text. References References The format of references varies from a journal to a place. For chemistry laboratory reports, you should follow, by default, the ACS guidelines, as outlined in the ACS Style Guide and the Journal of the American Chemical Society, JACS (all examples given in this document are consistent with the JACS format). If your teacher asks you to conform to a specific journal format, see the articles in that journal or see the magazine's Authors' Instructions. The specifications for most ACS logs are: 1) References must be compiled at the end of the job in the References section. 2) References must be numbered in the order in which they appear in the newspaper. For quotations in the narrative, the numbers must be overscripted and appear after the punctuation mark. y lines must be inserted between the reference entries. 4) This section should be double spaced just like the rest of the paper. 5) A reference is listed only once in the References section. If more than one reference quotes are made in the text, then the number corresponding to that reference is placed in the text each time. Common abbreviations used in footnotes and references (e.g. op. cit., ibid.) are not generally used in scientific writings. Types of reference items. Journal items are the primary source found in lab reports. An example is given below. Notice that the authors' initials are given instead of the first and last names. Also, there is no and before the last author's name. Some journals require the article title to be included in the reference (see the instructor to see if he wants you to use this style). When included, the title of the article should start with a capital letter, but the other words in the title, unless they are appropriate nouns, should not be capitalized (see below). The title of the journal is abbreviated (click here for a list of ACS abbreviations for common logs). Also, the year and comma after the year are bold. Finally, the reference has inclusive paging (the first and last page are given) The following are examples of the same journal article with the first given in style where the title of the article is included in the reference, while the second is in the style in which the title of the article is omitted. (1) Bergmann, U.; Glatzel, P.; deProot, F.; Cramer, S. P. High Resolution K captures X-Ray fluorescence spectroscopy: a new tool for chemical characterization. J. Am. Chem. Soc. 1999, 121, 4926-4927. (1) Bergmann, U.; Glatzel, P.; deProot, F.; Cramer, S. P. J. Am. Chem. Soc. 1999, pp. 121, 4926-4927. Books. The books should be quoted as follows: (2) Brünger, A. T. X-PLOR Manual, Version 3.1: An X-ray crystallography and MRI system; Yale University: New Haven, 1990; pp. 187-206. (3) Cheatham, T.E., III; Kollman, p.a. In biological structure, movement, interaction and expression Sarma, R. H. and Sarma, M. H., Eds, Adenine: New York, 1998; p. 99. Computer programs. Quotes for computer programs vary. If a person in academia has written the program, there is often a source of journal-article. In other cases, the program is simply distributed by a company. Article of the journal (4) Humphrey, W.; Dalke, A.; Schulten, K. VMD: Visual molecular dynamics. J. Mol. Graph. 1996, 14, 33-38. Company distribution (5) Case, D.A.; Pearlman, D.A.; Cladwell, J. W.; Cheatham, T.E.; Ross, W. S.; Simmerling, C. L.; Daren, T.A.; Merz, K.M. Stanton, R. V.; Cheng, A. L.; Vincent, J.J.; Crowley, M.; Ferguson, D.M.; Radmer, R.J.; Seibel, G. L.; Singh, U.C.; Weiner, P. K.; Kollman, P.A. AMBER version 5.0; University of California: San Francisco, 1997. (6) Insight II; San Diego, CA: Molecular simulations, 2000. Websites. Log articles are much more preferred than websites. Websites are dynamic and usually not evaluated by colleagues. One of the only cases where a website is an acceptable reference is when it refers to a database (however, an article is usually associated with creating the database). If you need to use a website, the reference should include a title for the site, author(s), year after the last update, and URL. It is unacceptable to use a website as a reference for scientific data or explanations of chemical processes. (7) Cheatham, T.E., III Simulation protocol for polynucleotides; 1998, . Tables, schematics, and figures Tables, schemas, and figures are concise ways to convey your message. As you prepare these items for the report, be sure to think about your reader. You want them to get the maximum amount of information with the minimum amount of work. Pretend you're the reader and ask yourself, Does that improve my understanding?, Can I find everything?, Can I read it without being distracted? Ill-prepared tables, schematics and figures will reflect badly on your science, and you, as a scientist, think carefully about these elements as you prepare your report. Tables A table is a way to summarize data or ideas in a coherent, grid-like way. This is not simply exiting a spreadsheet! You should prepare the table in a word processor so that its formatting matches the rest of the report. In general, tables do not have more than ten rows and columns to avoid overpowering the reader. A common exception is in review articles (such as in Chemical Reviews), where an author is trying to summarize the results in an entire field. Another common exception is the reporting of X-ray crystallographic data. their own special formatting rules and will not be discussed here. Tables are named in Table text #. Tables, diagrams and figures are labelled separately, with Arabic numbers, in the order in which they are mentioned in Tables have a table caption, which in some journals appears above the table, while in others it appears below. In both cases, the table legend is always on the same page as the table. Do not use lines or boxes in the table, unless absolutely necessary. Use spaces between columns (useful suggestion: It's better to use the text processor table formatting tools than to try to get the columns to align using tabs or spaces). All column or row headings should have clear subtitles and units if necessary (usually in parentheses). Any numbers that are presented should have corresponding significant digits, and an indication of the error should be displayed (click here to review how to report uncertainty in someone's data). An example table is shown below. Table 1. Aminoacylation efficiency of duplexAla substrates containing base pair substitutions at position 2:71. 2:71 Basic PairKcat/KM (relative)aFold descending rb-ρρGρ (kcal/mol)c G:C (wild type)10 Watson-Crick Pure:Pyr Basic pairs I:C0.511.90.39 G:4HC0.0 253.90.81 2AA:U0.234.30.86 2AP:U0.185.61.0 aValuereported are averages of at least three determinations with average standard deviations of ±26%. bThe closing in kcat/KM is given in relation to the wild duplexal. is defined as RTln[(kcat/KM)variant/(kcat/KM)type wild], where R=1,98272 horse/mol•K and T=298 K. Schema A is usually a sequence of two or more chemical reactions that together summarize a synthesis. A scheme may also show the stages of purification with each stage or reaction indicating the reactants, products, catalysts and yields. A scheme showing a chemical reaction may also present possible intermediaries. Note that the mechanisms are not usually transmitted using a scheme because they are more complicated and illustrate where the electrons are proposed to move. Mechanisms are most often placed in a figure. It is a common convention in a scheme to write a bold number under the chemical species mentioned in the text. Note that for the first appearance of the bold number in the text, the name of the chemical is given, but after that only the bold number is used to identify it. This method of defining abbreviations for compounds can also be done in the experimental section, where there is no scheme. This is very useful when the name of a compound is long or complicated. The yield in a single step is usually written on the right side of the equation, although it is also appropriate to write the yield under the arrow. Also note how reaction conditions can be summarized (for example, the first step below), which saves the reader from flipping to experimental studies for these details. Each scheme also has a caption, which is included in the system. The legend should briefly summarize what is in the scheme. If the schema comes from another source, the reference to this source should appear at the end of the caption. The following: an example of a schema that might appear in a synthetic paper. The text below shows how the scheme could be mentioned in the body of the work. Scheme 1. Synthesis of benzoyl chloride (3). Benzamide (1) was refluxed under aqueous acidic conditions for 1 hour to produce benzoic acid (2). The acid (2) was then refluxed with $SOCL_2$ to produce benzoyl chloride (3). Sometimes a schema can be used to illustrate a nonchemical process or how the components of a tool are connected. They could also be presented as figures, and there is no definitive rule that will tell you when to use a schema and when to use a figure. When in doubt, think of the reader and use the method that transmits the most information in the most understandable format Figures fall into two broad categories; those that are pictorial representations of the concepts that are presented in the text, as well as those that summarize the data. Again, it is essential for your report that your figures are clear, concise and legible and that they support the arguments you make. Remember that you have to refer to and discuss each figure in the text! If a figure is not mentioned, you don't need it! Figures that are pictorial representations of concepts usually appear in Introduction, but it is also appropriate to include them in Discussion. Use this type of figure to make writing more concise (remember the conversion factor: 1 image = 1 kword). Remember, people are very visually oriented and we can understand complex concepts presented as an easier image when they are presented in words or as mathematical formulas. Some examples of concept figures include: 1) An illustration of the deposition of metals on a silicon wafer. 2) A diagram of the HIV lifecycle. 3) A representation of microwave ovens exciting water molecules. 4) A diagram illustrating the Frank-Condon principle. 5) A proposed organic mechanism. Charts are figures that show data. Use a graph when you have more data than fit in a table. The general rules for preparing good figures for your notebook also apply in a laboratory report (click here to review the preparation of the graph). Formatting Tips: Don't use colored backgrounds or gridlines, or draw a box around the graph. You may find it more concise to combine all the data into a single graph. For example, it may be appropriate to put six time-absorbing lines with different concentrations of a reagent on the same graph, rather than building six different graphs. However, when doing this, be careful not to overcrowd the chart. Standard curves do not included in this section, unless this was the main objective of the experiment. They should be entered in the supporting information. The figures have figures of figures compiled in the Figure Caption section, located on a separate page at the end of the work. Work. chose this format because of typographical problems, and was preserved despite its inconveniences to the reader. Each digit should appear on its own page in the order is that it is discussed in the text. The captions of the figures appear in the Figures figure section and do not appear on the same page as the figure. However, in the lower right corner of the page appears the following identifying text: The last name of the first author et al., figure name Figure Legends All legends of the figure (legends) should be found in the section entitled Figure Legends. The format for a figure legend is usually: Number of figures (cursive and bold), a short title (followed by a point) and then a description of what is in the figure. All figure captions are compiled on the same page separated by an empty line. Make sure that you define in the caption any symbols used in the figure, and note whether the lines that pass through the data points are suitable or guides to the eyes. Example Figure Caption Figure 1. Nucleic acid bases. Chemical structures of (a) adenine, (b) guanine, (c) cytosine and (d) thimine. Support Information This section (also known as Additional Material) is where you can include information that may be useful, but not essential, for evaluating your data. Items in this section may include calibration curves and spectra (from which you have extracted a single absorption value for your analysis). Figures or data tables the content of which has been summarised in the text or which were not essential for conclusions should also be placed in the supporting information. An example of this type of material is the table of the positions of the atom generated in a crystalline X-ray structure. Click here to get this file in PDF format. (link not yet active) 2. Click here for an example of a completed laboratory report. 3. ACS Style Guide; the next day; Dodd, J. S., Ed.; American Chemical Society: Washington, D.C., 1997. 4. Cabin, W.C.; Colomb, don't tell me it's in c G. G.; Williams, J.M. The Craft of Research The University of Chicago Press: Chicago, IL, 1995. 5. Spector, T. J. Chem. Educ. 1994, 71, 47-50. Click here to see as a PDF file (Truman addresses only). 6th. American Chemical Society Instructions for Authors, 2007. B. Inorganic chemistry training for authors, 2007. c. Chemical Reviews Instructions for Authors, 2007. 7. Any non-English word should be italicized. This includes the Greek and German words, as well as their abbreviations, which appear as part of the chemical names (e.g. ortho-, meta-, para-, cis-, trans-, E-, Z-, alpha-, beta-, etc.). Also, italysed are condensed forms of secondary (sec-), tertiary (third-), etc. The main exception to the word italization rule are Greek and Latin prefixes that denote numbers in chemical names (e.g. mono-, bi-, tri-, etc.). Some common Latin expressions that appear in are infra vide (see later), vacuum sup (see earlier), et al. (abbreviation et alia, Latin for others), for example (from Latin exemplary grace, for example, not usually italysed) and i.e. (from Latin id est, it is also not usually italianized). Other Latin expressions and abbreviations commonly used in footnotes and references (e.g. op. cit.) are not used in scientific writings. Written.