Name: _____ Section: _____

Mini-Report 1 – How Do Scientists Report Data?

In order for science to progress forward, it is important for scientists to communicate their results to each other. This allows scientists to learn from each other's results, to notice and analyze trends across multiple sets of experimental data, to propose new theories to account for phenomena seen across multiple scientific areas, and to question and verify other scientists' experimental results.

As such, scientists strive to report their results clearly, concisely and broadly to other scientists. To assist in broad distribution of these results, a large number of scientific journals are published every year. Some journals are published monthly or quarterly, while others are published weekly. Some journals have very narrow target audiences, while others target entire disciplines or even cross-disciplinary audiences. While individual journals may have specific formatting requirements, most scientific articles are written in the same general format. The purpose of this assignment is to introduce you to the way that scientific articles are written.

Instructions:

1) Download the sample scientific report from the Chemistry Department website.

2) Write a short written summary (in paragraph form) of the way in which the scientific report is written. Your summary should be typed, 1–2 pages in length, 12 point font, and double spaced. Your summary should address the following questions (not necessarily in this order):

    a) There are six sections of the sample report, each of which is clearly identified with a bold title. What is each section called? What is the apparent purpose of each section? How do they differ in purpose? Why might other scientists want the report to be divided into clearly identifiable sections?

    b) Is the paper written in first–person ("Next, I added 3.21 grams of salt"), second–person ("Next, add 3.21 grams of salt"), or third–person ("Next, 3.21 grams of salt was added")? Is the paper mostly factual in nature, or does it contain many opinions? In which (if any) labeled sections are the author's opinions included?

3) Be sure to include your name on your written report.

Name: _____ Section: _____

Mini-Report 2 – Abstract

The "abstract" section of an experiment report is essentially a miniature version of a complete experiment report. It contains a brief statement about the background of the experiment, includes a brief summary of the procedure, and thoroughly summarizes the results and conclusions of the experiment.

While it may sound easy to write a miniature report, it is actually very challenging, because the abstract is the shortest section of the report – usually around half of a page, and certainly no longer than an entire page. When writing a full experiment report, it is usually easiest to write the abstract last. That way, you already know what you will be writing about in your report and you can simply summarize what you've already written.

The key to writing a good abstract is to be very concise, omitting unnecessary information and focusing on the essential points of each section of your report.

As with any section of your report, if you reference any external sources, you must include those references in your abstract.

Instructions:

Write an abstract section for the lab that you just completed. It must be double spaced, 12 point font, and should have your name on it. The references that you use to write your abstract section should be cited in a separate "references" section.

Name: _____ Section: _____

Mini-Report 3 – Introduction

The "introduction" section of an experiment report is essentially the first part of the formal written report. This section must convey two key pieces of information: 1) the background information that is necessary to place the experiment in context and 2) the purpose of this experiment.

Scientists rarely invent new areas of science. Instead, each scientific experiment uses information from previous experiments to place each new experiment in context. The key to determining what information must be included in the background portion of the introduction is to ask yourself: "What information did I need to know to understand this experiment?" You must then research all of this information and write a cohesive introduction describing the theories, laws, concepts, and equations that allowed your experiment to be conducted. Since all of this information was discovered in previous experiments, it is required that you reference the sources of information that you used to prepare your introduction. In the "real world," a scientist will only use primary sources when doing this research – that is, they will only reference the original experiments conducted and the original authors that conducted each experiment. For this class, however, you are allowed to reference secondary (or tertiary) sources, such as your textbook. These non-primary sources were written by authors who examined primary source material and then summarized the key findings in an easy-to-use format. The most important rules to remember, however, when preparing your background are: 1) if a law, theory, equation, or concept was needed to complete the experiment, then you need to describe that law, theory, equation, or concept in the background section of your introduction and 2) if you get information from ANYWHERE (lecture, lab manual, textbook, etc.), you need to reference the source.

After you have written your background section, the introduction must conclude with a statement of purpose. The statement of purpose explains what the purpose of YOUR experiment is. In other words, how will your experiment use the material that you wrote about in your background in a new and interesting way? The statement of purpose leads directly into the method / materials section of your report, so it serves as a transition from background material (other people's experiments) to your experiment.

The introduction section of a report is a bit challenging to write, because it requires the author to research the background material of the experiment. Because of this fact, authors typically write the background section of a report after they have completed the other parts of the report. That way, they will know which background material was necessary to understand their experiment and can focus their research on this material.

Instructions:

Write an introduction section for the lab that you just completed. It must be double spaced, 12 point font, and should have your name on it. The references that you use to write your introduction section should be cited in a separate "references" section.

Name: _____ Section: _____

Mini-Report 4 – Method / Materials

The "method/materials" section of an experiment report is the section in which a scientist communicates the specific steps that were done in order to perform the experiment described in the report. This section must be clearly written so that another scientist would be able to duplicate the experiment exactly. This section may allude to data collected during the experiment, but the data is not typically given explicitly and no calculations are shown or performed in this section of the report. The data is not analyzed in any way within this section and conclusions are not drawn from the results of the experiment within this section.

The method/materials section serves as a record of the experiment that was performed. It is NOT an instruction manual or recipe for future students. Therefore, if your lab manual says "Add about 0.3 g of salt", you would write "0.321 g of salt was added" in your report. The methods/materials section is typically written in the third-person and NOT in the first person (***incorrect:*** "I added 0.321 g of salt") or in the second person (***incorrect:*** "Add 0.321 g of salt"). Also included in this section are the observations made by the experimenter as the experiment was performed. If the color of something changed or if something started to boil when you heated it, then this should certainly be mentioned in the procedure. ***Example:*** "The solution was brought to a boil and the blue precipitate changed to a dark black color over a period of six minutes."

In order to ensure that future scientists who are following your procedure are not injured, it is imperative that you include any safety information that scientists should be aware of. If something is dangerous or toxic, this should be mentioned explicitly in your procedure, and your procedure should explain how to avoid any potential problems or accidents associated with this danger.

Your procedure should be written using language that could be understood by a future student who has taken as much chemistry as you have, but has never done or seen this experiment. That means that it is not necessary to explain HOW to weigh something or to use a thermometer, but it may be necessary to explain specific details about THIS experiment, particularly if you had never done an experiment before that was comparable to this one.

Instructions:
Write a method / materials section for the lab that you just completed. It must be double spaced, 12 point font, and should have your name on it. If you use any references to write your method / materials section, they should be cited in a separate "references" section.

Name: _____ Section: _____

Mini-Report 5 – Results / Calculations

The "results / calculations" section of an experiment report is the section in which a scientist communicates the specific results (including all numeric data) of the experiments performed and also shows any values that can be calculated from the numeric data obtained. The "results / calculations" section should be free of opinion. This allows another scientist to view the data obtained from the experiment without being biased by the author's own opinion of the experiment performed. Any commentary about whether the experiment was successful or what should be done differently is NOT included in this section of the report. Any conclusions that are not immediately obvious from the data given should also be excluded from this section. (For example, it's alright to state that the percent yield was "98.6%," but it is not alright to state that "this percent yield proves that mass is conserved for this specific reaction." Not only is this an opinion, but there is no obvious equation for "proof".)

Experimental data obtained may be presented in a variety of ways. If an experiment or calculation is done only one time, the data is typically mentioned in the text. If an experiment or calculation is repeated, however, the data is typically given in a table. Sometimes graphs are also made from the data obtained during the experiment. Any graph or table must be numbered and a caption must be provided that explains what the graph or table represents. Graphs and tables are numbered independently. (Example: a report may include a "Table 1," a "Figure 1," and an "Equation 1." The first table is called "Table 1" and the first graph is called "Figure 1," even if these are unrelated).

Any equations that were solved are also explicitly shown (and numbered) within this section. You should also show a "sample calculation" in which your data has been plugged into the equation and the answer is shown so that a reader can see how your data is used to reach the final answer. If an equation is used more than one time, then only one sample calculation should be shown. If a calculation is very obvious (for example, taking an average), then it may be omitted completely. Consult your instructor as to what calculations are "very obvious." When in doubt, include the equation!

Any tables, figures, equations, etc. that you have numbered MUST be explicitly mentioned in the text. Imagine that these tables, figures, equations, etc. are NOT a part of your report. Instead, the text of the report should discuss the results and calculations and then refer to the tables, figures, and equations in which those results can be found. The reader is expected to "find" the table, figure, or equation as it is mentioned in the text. (Example: "The mass of each metal was converted to moles using *Equation 1*, and the results were graphed versus heat capacity, as shown in *Figure 1*.")

Instructions:

Write a results / calculations section for the lab that you just completed. It must be double spaced, 12 point font, and should have your name on it. If you use any references to write your results / calculations section, they should be cited in a separate "references" section.

Name: _____ Section: _____

Mini-Report 6 – Discussion / Conclusion

The "discussion / conclusion" section of an experiment report is the only section in which a scientist communicates his or her opinions of the experiment performed. For example: Did the experiment work well? What should have been done differently? How does the scientist know whether or not the experiment was successful? These are all considerations that the scientist must make when writing the concluding section of the report.

There are basically three parts to this section: (1) Interpretation of the results – the author must explain how the theory (discussed in the "background" section of the report) allows for the numeric and observational results to be interpreted and must use the theory to draw conclusions about the experiment (was it successful, what were the identities of unknown substances or numeric quantities, etc.). Be sure to address any questions asked in the lab manual! (2) Discussion of error – no experiment is perfect. In fact, most experiments have some minor (or perhaps major) errors involved. The author must interpret these errors to determine their source and significance. Common (minor) errors include transfer loss (each time you transfer a substance from one container to another a small amount is left behind), equipment calibration (for example, a graduated cylinder is only accurate to ~0.5% of the total volume), estimation of "significant figures" (since you estimated the last digit, this digit could be inaccurate by a small amount), etc. Less common (major) errors result from things like incomplete reaction (you didn't allow the reaction enough time to reach its conclusion), "wet products" (you were weighing a wet solid, so the extra mass is from your solvent), spillage (you spilled part of your product, so you got less than you expected), etc. A scientist must interpret the accuracy of the results and account for any errors with logical reasoning. For example, if you have a 50% yield, this is probably NOT due to transfer loss (you "accidentally" left half of your product behind?!?!) but MIGHT be due to incomplete reaction. (3) Room for improvement – a scientist's job is never complete. If you were continuing to study this reaction, what would be done next? You should propose ways to improve the experiment and may also wish to suggest future experiments that could be conducted.

Instructions:
Write a discussion / conclusion section for the lab that you just completed. It must be double spaced, 12 point font, and should have your name on it. If you use any references to write your discussion / conclusion section, they should be cited in a separate "references" section.