Formal Report for the Atomic Absorption Lab

Fall, 2017

Technicalities

The report will be turned in in two parts. Part A is due Nov. 22nd and Part B is due Dec. 4th. In part A, you are expected to turn in the Introduction and the Experimental Methods sections of the report, along with references (see discussion of parts under "Details" below). Part B will be the full paper, but grading will be based on the Results and Discussion section (as well as updated references and turning in a complete paper). Part A should be 1.5 (min) to 4 (max) double-spaced pages (including graphs, figures, and references) using 12 pt Times New Roman font on 8.5 x 11 inch paper. Part B (full paper) should be 3 (min) to 6 (max) double-spaced pages (all parts – including Part A sections) using 12 pt Times New Roman font on 8.5 x 11 inch paper. If graphs and figures are included, they should not take up more than a total of one page in all. Cover pages, which are not required, do not count toward the page total.

Details

The purpose of formal report is to describe the analysis of your **tap water sample**. You could think of it as a report to a client that has hired you to analyze their water for Ca^{2+}, Mg^{2+}, Cl^-, NO_3^-, and SO_4^{2-}. There normally is a fair amount of freedom in how such technical reports are organized. However, to make it easier for us to compare different reports, we request the report to have the following parts:

1. An **Introduction.** You should indicate the purpose of the report and include a brief discussion of what affects the measured ion concentrations in Sacramento and surroundings (e.g. how such ions get into the tap water). Also, you should indicate why it is of interest to know the concentrations of each ion measured (e.g. do high concentrations of specific ions have negative effects on its use for drinking or cleaning?). You can also use information in the class website or other sources to discuss water quality. You may be able to find information on ion concentrations for your water sample from a water agency. You are expected to look up reference information beyond what is in the lab manual or textbook and to cite this information in the reference section.
2. An **Experimental Methods** section**.** This should include a brief description of how the atomic absorption spectrometer (AAS) works and the methods you used to analyze the samples. It is important that the description of the instrument is accurate. Although we will not be covering the functioning of the instrument in the lecture, you should have information on how the instrument works from lab lectures, the lab syllabus, and from the Harris text book (see Chapter 21). A similar description of the ion chromatograph is also required (you may want to read the related sections of Chapter 26 of Harris). You may want diagrams to explain how instruments work (cite if you use someone else's figure).

When writing a description of the methods, you will also need to discuss how standards and samples were prepared for analysis (this was a big part of the AA analysis preparation). This should include how standards were prepared, how the tap water sample was diluted, and how samples were analyzed. It is not helpful to restate the

procedure in the lab syllabus. For example, writing "we calculated the dilution factor necessary to produce four Mg^{2+} standards into the 0-1.0 ppm range") does not tell the reader what dilution was used or, more importantly, the actual Mg^{2+} standard concentrations or range of Mg^{2+} standard concentrations. This section does not need to be highly detailed. For example, a detailed list of operational parameters of the AAS, including slit widths and flow setting, is not needed. Be sure to explain how calibration was performed for both AAS and IC methods.

3. A **Results/Discussion** section. This section should include the tap water Ca^{2+}, Mg^{2+}, Cl^-, NO_3^-, and SO_4^{2-} concentrations, a discussion of the quality of the results, and a discussion of what the concentrations mean in the context of other measurements or water quality limits. To discuss the quality of the measurements, you may want to provide the calibration curves that you produced, the uncertainty in the tap water concentrations, and the error in the unknown measurement (this should be available when the non-formal AA lab report is returned). A discussion of the meaning of the tap water concentrations normally will also include a comparison to measurements from other samples collected in the vicinity, if possible, and/or from water agencies. Data from several past classes is available on the website. Compare your tap-water with other areas as well. Note that some seasonal and localized geographic variability is expected so that a 20% difference, for example, from a water agency or class median value, is not at all unexpected. Further variation is possible in drought years. If any of your measured concentrations are unusually high or indicative of unhealthy water, state why that is.

Important Caution: If you take specific information from sources such as the Harris textbook (as mentioned above), they should be referenced. You should try to write descriptions in your own words. Copying whole sentences or phrases from other sources without putting them in quotations is considered plagerism (a form of cheating by stealing someone else's writing). You are welcome (in fact recommended) to work with others provided you are doing the writing yourself. A positive way to work with another is to exchange completed reports and proof-read each other's reports. Students found to have major parts of the report written identically to others may be considered to have plagerized their reports.

<u>Grading</u>

Part A

1) Appropriate Title, Name and Section Number
2) Introduction: **[1 pts]**
    a) Clear statement of objectives of report
    b) Sources of Ca^{2+}, Mg^{2+}, Cl^-, NO_3^-, and SO_4^{2-} in drinking water. Numerical rank of what constitutes soft, medium and hard water (Remember that ppm $Ca^{2+} \neq$ ppm $CaCO_3$)
    c) Problem with water hardness in home and industrial units.
    d) Health & application of NO_3^- ion. Acceptable NO_3^- ion concentration in water.

3) Experimental methods: **[1.5 pts]**
    a) Description of how AAS works (should contains a basic instrument schematic)
    b) Description of standard solution preparation and sample dilution.
    c) Description of how IC works.
    d) How did you find concentration of anions in your tap-water (i.e., 1 point calibration curve)?
4) References + meeting page limits **[0.5 pts]**
5) Correct format & organization **[0.5 pts]**
6) Writing quality:
    a) Spelling + Grammar **[0.5 pt]**
    b) Clarity in writing (reader doesn't have to guess meaning of sentences) **[0.5 pt]**
    c) Accuracy in writing (descriptions of instruments, for example, accurately describe how they work) **[0.5 pt]**

Total: 5 pts

Part B

1) Appropriate Title, Name and Section Number
2) Results and Discussion **[2.5 pts]**
    a) Concentrations of each ion (or state below limit of detection/quantification)
    b) Discussion of data quality including calibration, percent standard deviation and accuracy of water hardness unknown. Discussion of limits of one point calibration.
    c) Discussion of results of drinking water analysis
        i) Comparison of drinking water concentrations with expected values (from class measurements and/or water agency results)
        ii) Compare to greater Sacramento values
        iii) Note if above any limits (e.g. listed maximum concentration limits)
3) Added references (if needed), kept Intro and Experimental Methods sections + meeting page limits **[0.5 pts]**
4) Correct format & organization **[0.5 pts]**
5) Writing quality:
    a) Spelling + Grammar **[0.5 pt]**
    b) Clarity in writing (reader doesn't have to guess meaning of sentences) **[0.5 pt]**
    c) Accuracy in writing (concentrations, data quality, and comparison are consistent with data/sources) **[0.5 pt]**

Total: 5 pts
Note for both sections: Additional points can be removed if parts are improperly referenced or plagiarized.