

# Lab Report Format and General Guidelines: Chem 214

Lab reports for Quantitative Analysis are more detailed than those in General or Organic Chemistry laboratories. The lab report is a **VERY IMPORTANT** part of a laboratory-based course, both at the undergraduate and graduate levels. It allows you to articulate the work you did in report form and reflect on the data.

The entirety of the lab report should be written using the student's own words. While it may seem easier to copy certain portions from handouts, such as the methods, this is **plagiarism** and is not acceptable for academic writing, and it is certainly not acceptable for the scientific literature. When writing the laboratory report it is important to be very clear and concise in your writing. Details do matter and the slightest change in wording may distort the original intent of what was written.

Basic formatting: 12pt Times New Roman font, 1 inch margins double-spaced, and out of the spirit of sustainability do try to print the lab reports double-sided. Lab reports must be stapled together before submission. Define each section within the lab report in **bold (Introduction, etc.)** with the respective element names described below.

**Lab reports must consist of the following elements:**

## **Title page –**

- Lab experiment title and number centered on the page;
- Your name, lab partners name (for partner labs only),
- Course section #,
- TA's name,
- Unknown number and
- Date the report is due should be in the lower right corner of the page.

**Introduction/Purpose** – begin with a statement of the reason for completing the experiment and the goal of the work. Then, expand on the chemistry principles. Any relevant CHEMISTRY i.e. chemical reactions must be in the introduction! This is NOT a rehash of the lab procedure so do NOT simply summarize the procedure [will not receive credit for that]. Introduce principles, techniques i.e. what is being learned and accomplished as a result of completing the lab experiment. MINIMUM length is 1 page, double-spaced. Maximum is 2 pages double-spaced.

**Procedure** – a *narrative* of all the steps necessary to perform the experiment, including any changes that may have been made to the original printed procedure.

- This must be summarized from the lab manual in complete sentence form. Do NOT copy the lab manual word for word. Procedure must be written in one's own words! **Do not plagiarize.** The lab manual must be cited at the end of this section!
- CANNOT use bullet points. NARRATIVE form is required.
- ALWAYS note starting & ending color of a reaction mixture (i.e. indicator use for example)
- It must be so clear that anyone not familiar with the lab would know exactly what to do.
- It should not contain the actual masses, volumes, etc. used by the student.
- Be careful writing preparation instructions for solutions. You will dissolve/dilute chemicals in a volume smaller than what the final volume will be and then dilute to the final volume mark. *For example:* Dissolve approximately 12 grams of potassium hydroxide (KOH) in 300 mL H<sub>2</sub>O, dilute to 500.00 mL mark in a volumetric flask, parafilm, and invert to mix.
- It should NOT be in 1<sup>st</sup> or 2<sup>nd</sup> person (no "I", "you", "we", "he" or "she")

## Results – list data obtained, such as volumes, weights, & temperatures, **in a table format**

- Be mindful of SIGNIFICANT FIGURES of glassware!
- Define chemical formulas, abbreviations before use: sodium hydroxide (NaOH), milliliters (mL)
- Multiple trials are necessary to verify data has good precision. All data must be shown, including repeat 'redo' lab experiment data if applicable.
- Data must be represented in table format with appropriate column and row headings and include individually determined trials' values, averages (concentrations, percent, unknowns, etc.), standard deviation, ppt and other. When applicable include units in column headings i.e. "NaOH volume (mL)" or "mL of NaOH." Tables must be labeled with appropriate brief titles describing the contents within.
- Statistical analysis (average, standard deviation, Grubb's Test, parts per thousand, etc.) of data should also be included in this section whenever these statistics are applicable.
- ALWAYS note starting & ending color of a reaction mixture (i.e. indicator use for example)
- If applicable, include graphs/figures. All must be labeled with a title, proper x and y axes labels (including units). Graphs should be constructed in Excel or a similar program.
- If graphs/figures are included (spectra, chromatograms, or calibration curves) they must be properly labeled i.e. Figure 1, and brief description directly below it.
- Include calculations labeled appropriately with chemical units.
- Properly identify what is being calculated and the trial # the calculation is being completed for.
- Include general (also known as skeletal) equations corresponding to each calculation i.e. general equation for **dilutions** (see example), average, standard deviation, ppt, to name a few.

*Example calculation for volume of HCl for 0.100 M HCl. The calculations may be written in pen neatly so they can be read and understood. Show an outline of equation being used and at least one example with your values ex.:  $M_1V_1=M_2V_2$        $12.0\text{ M} \times (V_1) = 0.100\text{ M} \times (1000.00\text{ mL})$        $V_1=8.33\text{ mL}$   
Please utilize leading zeros before the decimal point (0.1 mL and NOT .1 mL).*

- **A required paragraph explaining the results must also be present** to show the student interpreted the experimental results/data shown in tables, figures, and/or graphs. Results include standardized molarity work AND the unknown analysis.

## Conclusion – a restatement of results, and what the results reveal

- The first sentence should state the purpose of the lab experiment. Then, state the unknown #, composition/molarity of the analyte, standard deviation, and ppt of the work. This part can be similar to the Results paragraph but NOT just a copy.
- Discuss precision (ppt); discuss accuracy based on Sakai accuracy grade. State your confidence level in the experimental work completed.
- Include a **detailed** analysis of error (**3 separate errors**) in paragraph form based on student's own data/results. Analysis of error may be on theoretical errors too, even though a student may not have actually made the error(s). Errors must be TECHNIQUE dependent.

*An example is improper buret reading and how it affects all measurements and calculations. How does the error affect subsequent steps in the lab experiment? How does it change the calculated value of an analyte (concentration higher/lower than it would be if mistake didn't occur, etc.)? \*Dirty glassware & blaming instrumentation or raw chemicals for example, is NOT a valid error*

- MINIMUM length of the conclusion section is 1 page double-spaced; there is no maximum limit.

## Additional Considerations

- The lab report components must follow the order as listed.
- Page numbers required in the bottom center of each page.
- All parts of the lab report must be typed (example calculations are an exception).
- Keep entire tables on a single page. If you must split a table, include column/row headings again on the second page.
- Lab reports must have good spelling, sentence structure, etc. Do not use run-on sentences, fragments, or personal pronouns (I, we, me, etc.). PROOFREAD!
- Use of SUBSCRIPTS and SUPERSSCRIPTS is required.