Experiment 6: Calorimetry and Hess' Law

Class Section #

Your Name

TA Name

Date Exp Completed

Date Report Submitted

Purpose

[Here you will put the purpose stated in the lab manual in your own words. Don't copy it exactly, or it is plagiarism. For example, a person might write the following]

In this experiment, correct methods for using an analytical and top-loading balance, as well as finding the density of an unknown solution by using a pipet and buret, will be investigated.

Procedure

[*Here is where you put a reference to the procedure in the book. Title, Volume, Year, Author, Exp # and Page Numbers. See following for example. You do not need to re-type the whole procedure. You should note any changes.]*

Please refer to *Chemistry 1210 General Chemistry Laboratory Manual*, 2016, Department of Chemistry, The Ohio State University, Hayden McNeil, Exp 5, pages 60-61, for the proper procedure.

Data

[*Fill out the report form in the template with the data you collected and calculated. Photocopies are not acceptable. If you use Excel and make the worksheets look like the report form, you can turn in the Excel worksheets. However, you will still need to leave in the report form from the template, even though it will be blank. Make sure you show the proper number of sig. figs. whether you use the report template or Excel (a little tougher but possible by setting the number of decimal places by highlighting the numbers, right clicking and choosing "format cells").]*

Sample Calculations

Trial 1, line 2 (provide trial # or soure and the line on the report sheet to which the calc. refers)

$$\text{Average Value} = \frac{13.32\text{g} + 13.32\text{g} + 13.32\text{g}}{3} = 13.32\text{g}$$

$$\text{Average Deviation} = \frac{(13.32\text{g}-13.32\text{g})+(13.32\text{g}-13.32\text{g})+(13.32\text{g}-13.32\text{g})}{3} = 0.00$$

[*Here you include sample calculations for all calculations as specified for in the rubrics.* These can be typed (suggested) or handwritten (in **pen).** If handwritten, scan or photograph them to include in the report. Make sure to watch your significant figures. When you have several trials or data for several compounds you need only show sample calculations for one trial or one compound. If you have the same calculations for several different lines (e.g. exp 12) you need to show sample calculations for one line only. Even if you use Excel to do calculations, you must still show sample calculations.]

Graphs

You need to use proper labeling with units for the axes and title. Make sure your scale is properly set so that the data points occupy most of the paper. Spread things out and don't have a lot of empty space. You should almost always be able to gain sig. figs. if you used the appropriate scales for the axes. See Appendices B and F in the manual for graphing techniques and examples. You can use Excel for your graphs (I encourage it). However, your graphs should still occupy the whole page and have appropriate axes, units, significant figures for labels, etc.. Also, use grid lines when you need to read things from the graph.

You will be graded on proper scales for the axes, titles, labels, curves (lines) drawn, interpretation of graphical results.

These should then be included in your Word document. Make sure you do this in a way it doesn't affect the margins for the graphs and they still fill the whole page. Copy them so it keeps the original margins set in Excel (Word has an option for doing this).

Report Questions

When necessary, answer the report questions on a separate piece of paper (only a few reports have these in the lab manual). Include the questions from the lab manual and number your questions. Always support your answers with calculations and/or explanations. A simple numerical answer without any supporting calculations or explanation is not enough and will not get credit. These can be typed or handwritten in **pen** (then scanned and included in the report).

Report questions are in the manual. You can also find them on the course web page under the lab link.

1. Answer to question 1.

3. Answer to question 3.

Results and Discussion

This is where you discuss your results. This should be in paragraph form, and probably around 1 full page, depending on the experiment (it doesn't need to be 5 pages long). This is the place where you can really show you understood what you did in lab and didn't just follow the procedure and write down numbers. This section consists of essentially three paragraphs. It should not include "I", "we", "my", etc. In other words you shouldn't have something like "I mixed the two solutions and a precipitate formed". Instead it should be something like "The two solutions were mixed and a precipitate formed" or "A precipitate formed upon mixing of the solutions". This should include facts without a lot of "fluff" or "feelings" (such as "This was a fun lab and I learned a lot").

*The **first paragraph** should include a synopsis of the experiment. There shouldn't be a lot of experimental detail but enough of a description so someone reading it would get the idea of what was done and what the experiment was about.*

*The **second paragraph** consists of your **final important results** (not all the intermediate results) and a discussion of those results. Are the results correct or reasonable (do they make sense, e.g. if you get a molecular weight of 10,000 amu that is not reasonable)? How do you know? For some experiments you should state whether you got the correct trends (e.g. exp 12 and heats of vaporization for the known compounds in exp 14) and how you know this. If you didn't get the correct results, what would you have expected and why. Include an explanation of your results based on what you've learned in the manual, lab and lecture.*

*The **third paragraph** should consist of any problems encountered during the lab or after and state any possible **sources of error** which may have caused inaccuracies in the results and how to minimize or correct them and be specific. You should inlcude at least **two inherent** sources of error. Inherent errors are errors over which you have little to no control due to the way the experiment was performed. It shouldn't just be things like "The equipment was bad" or "The chemicals provided weren't pure or the correct concentrations". Those are just "cop outs" which don't require a lot of thought. Only discuss*

instrumental errors which would effect the significant figures and accuracy of the final results. You should discuss accuracy and precision and how they affect the results. You should describe how the errors might affect the results and how they might be overcome. If you leave a data point off a graph, you should explain why you didn't use it. If you are taking an average of values and you leave a trial out because it is very different than the others you should note this on the report form and explain it here (and maybe even do an error analysis to show it is okay to leave out the value - see Appendix F, Treatment of Numerical Data, in the manual).

Conclusion

This is a brief summary (1 paragraph, about 5-6 sentences) of the entire experiment. This should include a brief description of the lab (1-2 sentences), your main results (actual numbers when appropriate) and answer the purpose (restate the purpose first, in past tense). Be sure to ALWAYS ANSWER THE PURPOSE. You should include what conclusion you've drawn based on the results.