CHEM 142 Aut 19 - (5) Friday Labs 142 Lab 4 Report: Calibration Curves and Beer's Law (take-home)

Wendy He

TOTAL POINTS

54 / 60

QUESTION 1

1 Pg 1 - Signature and Notebook Pages 10 / 10

✓ **+ 0 pts** **Signature is PRESENT (0.0 or -5.0)**

- 5 pts Signature is ABSENT (0.0 or -5.0)

✓ **+ 5 pts** **Purpose/Method pages meet expectations**

+ 3 pts Purpose/Method pages below expectations

+ 0 pts Purpose/Method pages not submitted

✓ **+ 5 pts** **Data pages meet expectations**

+ 3 pts Data pages below expectations

+ 0 pts Data pages not submitted

- 12 pts Up to 24 hours late

+ 0 pts No report submitted

QUESTION 2

Page 2 21 pts

2.1 Pg 2 – Data for Calibration Curve and Sample Prep (#1-#6) 7 / 7

✓ **+ 7 pts** **Data table for standards and items #1-6 (at bottom of page): complete and accurate**

+ 5 pts Data reporting: 1-2 entries are incorrect or missing or have incorrect sig. figs.

+ 3 pts Data reporting: 3-4 entries are incorrect or missing or have incorrect sig. figs.

+ 0 pts Data reporting: more than 4 entries are incorrect or missing or have incorrect sig. figs.

+ 0 pts Data comparison: notebook vs. report VERIFIED

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

2.2 Pg 2 – Calibration Curve Generation and Summary 12 / 14

✓ **+ 5 pts** **Graph: clearly and properly labeled (x, y axes and title)**

+ 3 pts Graph: some issues (1-2) with labels

+ 0 pts Graph: many issues with labels

✓ **+ 5 pts** **Data plotting: accurate, according to data in table, with trendline included**

+ 3 pts Data plotting: some minor errors in plotting

+ 0 pts Data plotting: major errors in plotting and/or no trendline

+ 4 pts Calibration summary: accurate based on graph and trendline; calibration equation is detailed

✓ **+ 2 pts** **Calibration summary: some minor errors in summary data**

+ 0 pts Calibration summary: major errors in summary data and/or calibration equation not detailed

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

QUESTION 3

Page 3 16 pts

3.1 Pg 3 – Determining Iron, #7-9 6 / 6

✓ **+ 6 pts** **All calculations are complete and accurate, with appropriate sig. figs. and correct units included**

+ 4 pts Some issues (1-2) with data/calculations and/or data summary at top of page is not reasonable

+ 2 pts Many issues (3-4) with data/calculations

+ 0 pts Too many issues with data/calculations

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

3.2 Pg 3 – Determining Iron, #10-12 6 / 6

✓ **+ 6 pts** **All calculations are complete and accurate,**

with appropriate sig. figs. and correct units included

+ **4 pts** Some issues (1-2) with data/calculations and/or data summary at top of page is not reasonable

+ **2 pts** Many issues (3-4) with data/calculations

+ **0 pts** Too many issues with data/calculations

+ **0 pts** Page improperly uploaded and/or not linked to question OR page is blank

3.3 Pg 3 – R&D Q#1 4 / 4

✓ **+ 4 pts Error analysis is complete (must include calculation of % error) with reasonable and targeted discussion**

+ **2 pts** Error analysis is incomplete (must still include % error calc.) with generalized and/or non-targeted discussion

+ **0 pts** Calculation of % error missing AND/OR several issues with discussion

+ **0 pts** Page improperly uploaded and/or not linked to question OR page is blank

QUESTION 4

Page 4 13 pts

4.1 Pg 4 – R&D Q#2 4 / 4

✓ **+ 4 pts Clear and reasonable arguments are presented for the conclusion**

+ **2 pts** Conclusion and/or reasoning has minor flaws

+ **0 pts** Conclusion and/or reasoning is incorrect or missing

+ **0 pts** Page improperly uploaded and/or not linked to question OR page is blank

4.2 Pg 4 – R&D Q#3 4 / 8

✓ **+ 4 pts Application to new data: correct with proper sig figs and units**

+ **2 pts** Application to new data: conclusion and/or calculation has minor flaws

+ **0 pts** Application to new data: conclusion and/or calculation is incorrect or missing

+ **4 pts** Dilution calculation: correct with proper sig figs and units

+ **2 pts** Dilution calculation: minor flaws

✓ **+ 0 pts Dilution calculation: incorrect or missing**

+ **0 pts** Page improperly uploaded and/or not linked to question OR page is blank

4.3 Pg 4 – Waste evaluation 1 / 1

✓ **+ 1 pts Waste evaluation is mostly complete and appropriate**

+ **0 pts** Waste evaluation is missing more than 2 items or there are multiple item for which no quantity is listed

+ **0 pts** Page improperly uploaded and/or not linked to question OR page is blank

Name: Wendy He **Quiz Section** AX
Lab Partner: Keivin Leong **Student ID #:** 1936063

CHEM 142 Experiment #4: Calibration Curves and an Application of Beer's Law

Goals of this lab:

- Apply the use of a calibration curve to finding the concentration of an unknown
- Apply the mechanics of dimensional analysis to calculate the mass of iron in a sample based on concentration of an iron-containing solution
- Develop lab skills in operating digital pipettes, volumetric glassware, and spectrophotometers
- Use Excel to graphically represent and interpret experimental data
- Asses the accuracy of experimental data (compared to a known value) and identify sources of error

Your lab report will be grade on the following criteria using a poor/good/excellent rating system (see the Lab 4 Self-Assessment for more details):

- Calculations are complete and correct, with proper use of significant figures and units
- Data and results are careful and accurate
- Lab report is clear, legible, and neat
- Error analysis is well-supported and valid
- All graphs and tables and clearly and accurately labeled; entire report is typed
- Application of skills to new situations is accurate and complete

By signing below, you certify that you have not falsified data, that you have not plagiarized any part of this lab report, and that all calculations and responses other than the reporting of raw data are your own independent work. Failure to sign this declaration will result in 5 points being deducted from your lab score.

Signature: __Shiyi He_____

This lab is worth 60 points: 10 points for notebook pages, 50 points for the lab report

1 Pg 1 - Signature and Notebook Pages 10 / 10

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- ✓ **+ 5 pts** **Data pages meet expectations**
- **+ 3 pts** Data pages below expectations
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- **+ 0 pts** No report submitted

NAME: Wendy He QUIZ SECTION: AX

DATA, GRAPHS AND CALCULATIONS

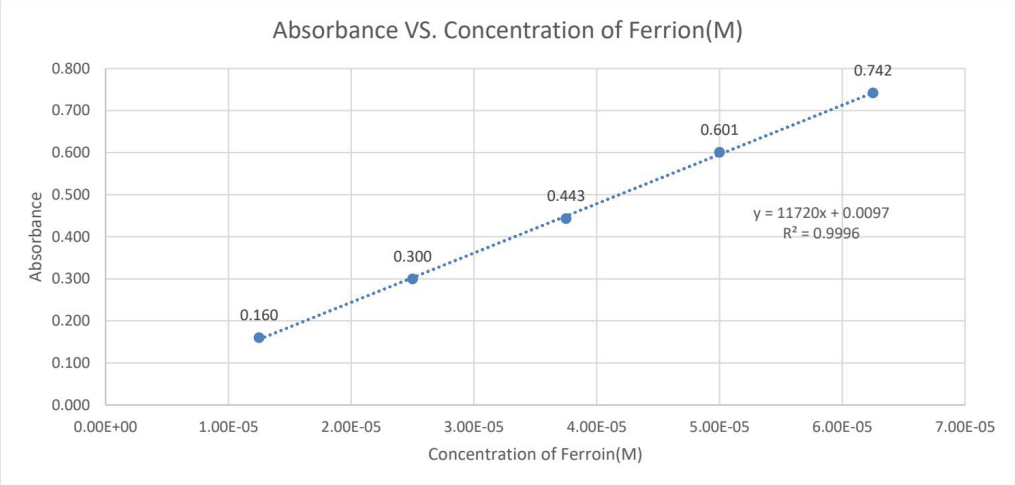
Creating the calibration curve:

λ_{max} for absorbance measurments: 510.4 nm (from Part III. B.)

Note:
All sections of this report must be typed

Ferroin Standards: (from Part III. C.)

Concentration (M)	Absorbance
1.25E-05	0.160
2.50E-05	0.300
3.75E-05	0.443
5.00E-05	0.601
6.25E-05	0.742



Slope of Absorbance versus concentration graph
11720 M^{-1} ← (enter #s here so the data will correctly autofill on pg 3)

y-intercept of Absorbance versus concentration graph
0.010 ←

Detailed calibration equation: Absorbance=11720[ferroin]+0.0097
(review the introductory information in the lab manual for an explanation of what is meant by a "detailed" calibration equation)

Determining the Amount of Iron in an Iron Tablet

1) Average mass of a tablet: 436 mg

2) Mass of crushed tablet used in analysis: 60.0 mg ← (enter a # here so the data will correctly autofill on pg 3)

3) Final volume after filtered crushed tablet solution is diluted in volumetric flask (lab manual Part II, Step 5): 100 mL

4) Volume of diluted crushed tablet solution transferred to the new volumetric flask (lab manual Part II, Step 6): 5 mL

5) Final volume of ferroin complex solution (lab manual Part II, Step 9): 100 mL

6) Absorbance of the ferroin complex solution (lab manual Part III, Step C.7): 0.130 ← (enter a # here so the data will correctly autofill on pg 3)

2.1 Pg 2 – Data for Calibration Curve and Sample Prep (#1-#6) 7 / 7

✓ **+ 7 pts** **Data table for standards and items #1-6 (at bottom of page): complete and accurate**

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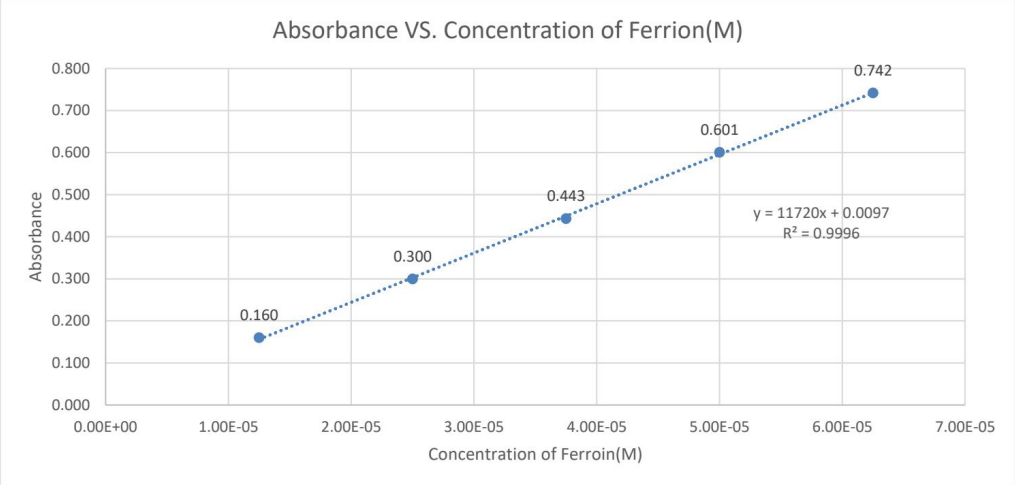

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6) Absorbance of the ferroin complex solution (lab manual Part III, Step C.7): 0.130 ← (enter a # here so the data will correctly autofill on pg 3)

2.2 Pg 2 – Calibration Curve Generation and Summary 12 / 14

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NAME: Wendy He QUIZ SECTION: **AX**

Student- specific data from pg 2 used in calculations autofill here on this page:

Calib. Curve slope:	11720	y-int of Calib. Curve:	0.010
Absorbance of digested sample:	0.130	Mass crushed tablet:	60.0

7) Using the calibration equation and the absorbance you measured for the prepared sample, calculate the ferroin concentration. Show your work and don't forget to include units.

0.13=11720[ferroin]+0.0097

0.1203=11720[ferroin]

[ferroin]=1.026e-5M

8) Based on the procedural steps and the ferroin concentration you just calculated, calculate the moles of ferroin in the final ferroin complex solution prepared in Part II, Step 9. Show your work, including units.

1.026e-5M = moles of ferroin/(0.1L)

moles of ferroin = 1.026e-6

9) Based on the moles of ferroin in the final ferroin complex solution, calculate the moles of iron in the crushed tablet solution prepared in Part II, Steps 2-5. Show your work, including units.

1.026e-6 moles of ferroin (1mol iron/ 1 mol ferroin) (100mL / 5mL)

=2.053e-5 moles of iron

10) Using the "moles of iron in the crushed tablet solution" you just calculated, calculate the mass (in mg) of iron in the crushed sample that you weighed out. Show your work, including units.

2.053e-5 moles of iron (55.85 gFe / 1mol of iron)(1000mg / 1g)

= 1.147 mgFe

11) From the mass of iron in the crushed tablet sample you weighed out, calculate the mass (in mg) of iron in a whole tablet. Show your work, including units.

1.147 mgFe (436 mg / 60 mg)

= 8.332 mgFe

12) mg of iron per tablet (as listed on the bottle) 27 mg

Results and Discussion

1. Compare your mass of iron per tablet with the amount listed on the bottle label. Calculate the % error and discuss YOUR major sources of error. How did this affect your results?

(27mg - 8.332mg) / (27mg) (100%)

=69.14%

We were rushing to finish the lab, and we did not wait fully five minutes to allow ferroin to fully formed. Because we had low ferroin concentration, so we got a low absorbance.

3.1 Pg 3 – Determining Iron, #7-9 **6 / 6**

✓ **+ 6 pts** **All calculations are complete and accurate, with appropriate sig. figs. and correct units included**

+ 4 pts Some issues (1-2) with data/calculations and/or data summary at top of page is not reasonable

+ 2 pts Many issues (3-4) with data/calculations

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3.2 Pg 3 – Determining Iron, #10-12 **6 / 6**

✓ **+ 6 pts** **All calculations are complete and accurate, with appropriate sig. figs. and correct units included**

+ 4 pts Some issues (1-2) with data/calculations and/or data summary at top of page is not reasonable

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3.3 Pg 3 – R&D Q#1 **4 / 4**

✓ **+ 4 pts** **Error analysis is complete (must include calculation of % error) with reasonable and targeted discussion**

+ 2 pts Error analysis is incomplete (must still include % error calc.) with generalized and/or non-targeted discussion

+ 0 pts Calculation of % error missing AND/OR several issues with discussion

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

NAME: Wendy He QUIZ SECTION: **AX**

2. If you did not wait for the complete formation of the ferroin complex in Part II, step 10, how would your Abs data be different? Explain how would this affect your determination of the mass of iron in the tablet?

I think the measured absorbance would be smaller than theoretical absorbance. Smaller absorbance means smaller mass.

3. You use atomic emission spectroscopy, another spectroscopic technique, to measure the Li^+ concentration in 5 standard solutions of varying concentrations of LiCl. The intensities for the standard solutions are plotted versus the concentrations and the resulting calibration equation is: Intensity = 82,985 M^{-1} * $[Li^+]$ + 2.15

If the intensity of your unknown sample is 132, what is the concentration of Li^+ in the analyzed sample?

132 = 82,985 * $[Li^+]$ + 2.15

129.85 = 82,985 * $[Li^+]$

$[Li^+]$ = 1.565e-3M

If 15 mL of the original unknown sample was diluted to 375 mL prior to analysis, what is the concentration of Li^+ in the original solution?

1.565e-3M (15mL / 375mL)

= 6.259e-5M

Laboratory Waste Evaluation

Laboratory waste is considered *anything* generated during an experiment that is disposed of down the sewer drain, thrown in the garbage, collected in a container for disposal by the UW Environmental Health & Safety department, or released into the environment. Based on the written lab procedure *and* your actions during the lab, list the identity and approximate amount (mass or volume) of waste that you generated while performing this experiment.

5mL of ferroin
60 mg iron tablet
2mL hydroxylamine hydrochloride
1mL of sodium acetate
4mL of 0.1M HCl
5mL 10-phenanthroline
6L DI water

4.1 Pg 4 – R&D Q#2 **4 / 4**

✓ **+ 4 pts** **Clear and reasonable arguments are presented for the conclusion**

+ 2 pts Conclusion and/or reasoning has minor flaws

+ 0 pts Conclusion and/or reasoning is incorrect or missing

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

NAME: Wendy He QUIZ SECTION: **AX**

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5mL of ferroin
60 mg iron tablet
2mL hydroxylamine hydrochloride
1mL of sodium acetate
4mL of 0.1M HCl
5mL 10-phenanthroline
6L DI water

4.2 Pg 4 – R&D Q#3 4 / 8

✓ **+ 4 pts** **Application to new data: correct with proper sig figs and units**

+ 2 pts Application to new data: conclusion and/or calculation has minor flaws

+ 0 pts Application to new data: conclusion and/or calculation is incorrect or missing

+ 4 pts Dilution calculation: correct with proper sig figs and units

+ 2 pts Dilution calculation: minor flaws

✓ **+ 0 pts** **Dilution calculation: incorrect or missing**

+ 0 pts Page improperly uploaded and/or not linked to question OR page is blank

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4.3 Pg 4 – Waste evaluation **1 / 1**

✓ **+ 1 pts** **Waste evaluation is mostly complete and appropriate**

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