Chemistry 330 - QUANTITATIVE ANALYSIS

Course Description: Chem 330 is a study of the common techniques and theory of gravimetric, volumetric, electrochemical, optical and chromatographic methods of analysis.

Course Information

Professor: Dr. Darwin Dahl email: darwin.dahl@wku.edu

Online Lectures accessed through Blackboard

I will hold question/answer sessions M-F from 9:00-am to 10:00 am via Zoom

Textbook: etext: Quantitative Chemical Analysis, Harris: 9th edition

Homework: Sapling

- Follow the Sapling Learning link from your instructor's course page.
- For initial registration, your Sapling Learning homework must be accessed through that link. After logging in once using this link, you can log in to subsequent sessions from your instructor's course page or from the Sapling home page.
- If you already have a Sapling account, enter your username and password in the login box. If the login box is disabled, scroll down to the Create an Account portion of the page, fill in the missing info and click Create My Account.
- You've been automatically enrolled into the appropriate homework course on Sapling Learning and will be directed to your course page.
- Review the system requirements and confirm that Flash is updated and enabled in your browser.

Need Help? Technical support team can be reached by phone, chat, or by email via the Student Support Community. To contact support please open a service request by filling out the webform: https://macmillan.force.com/macmillanlearning/s/contactsupport

Grading Policy:

Four hour exams will be given during the semester. The following grading policy will be followed:

4 hour exams	**50%**
Homework (Sapling assignments)	**10%**
6 Laboratory activities	**30%**
10 quizzes	**10%**

Projected grading scale:

88 - 100	A
77 - 87	B
65 - 76	C
52 - 64	D
- 51	F

Significant Dates:

June 8	**Class begins**
June 12	**EXAM I**
June 19	**EXAM II**
June 26	**EXAM III**
July 2	**EXAM 4**

Quizzes will be on Tuesdays and Thursdays (the remaining two will be announced)

Student Learning Objectives:

Students will demonstrate proficiency using chemical knowledge and problem solving skills in the following topics: basic statistics, acid-base chemistry and equilibria, solubility, redox reactions, and separation techniques.

Policies

A. Accommodations: In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu . Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

B. Academic Integrity: Academic Dishonesty - Students who commit any act of academic dishonesty may receive from the instructor a failing grade in that portion of the course work in which the act is detected or a failing grade in a course without possibility of withdrawal. The faculty member may also present the case to the Office of the Dean of Student Life for disciplinary sanctions. A student who believes a faculty member has dealt unfairly with him/her in a course involving academic dishonesty may seek relief through the Student Complaint Procedure.

Cheating - No student shall receive or give assistance not authorized by the instructor in taking an examination or in the preparation of an essay, laboratory report, problem assignment or other project, which is submitted for purposes of grade determination. http://www.wku.edu/undergraduatecatalog/

C. Title IX Misconduct/Assault Statement: Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at https://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf and

Discrimination and Harassment Policy (#0.2040) at https://wku.edu/policies/hr_policies/2040_discrimination_harassment_policy.pdf.

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121. Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and **MUST** report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

Tentative Lecture Schedule

Exam I Material

Chapter 1:	**Chemical Measurements** -	A review of solutions and their concentrations and stoichiometric calculations. Review of Titrations
Chapter 6:	**Chemical Equilibrium**-	A review of chemical equilibrium
Chapter 8:	**Activity and the Systematic Treatment of Equilibrium**	Activity and Activity coefficients in relations to solubility's and Systematic methods for solving multiple-equilibria
Chapter 27:	**Gravimetric and Combustion Analysis**	Treatment of Gravimetric procedures

Exam II Material

Chapter 3:	**Experimental Error**	Types of Error and Propagation of.
Chapter 4:	**Statistics**	Statistical treatment of errors
Chapter 9:	**Monoprotic Acid/Base Equilibria**	Strong acid/base and Weak acid/base equilibria
Chapter 10:	**Polyprotic Acid-Base Equilibria**	Equilibria involving polyprotic acid-base reactions, buffer solutions and alpha fractions
Chapter 11:	**Acid-Base Titrations**	Titrations and practical applications equilibria and applications

Exam III Material

Chapter 12:	**EDTA Titrations**	Complex-formation reactions, EDTA
Chapter 18:	**Fundamentals of Spectrometry**	Electromagnetic radiation, spectrum
Chapter 19:	**Applications of Spectrophotometry**	Applications
Chapter 20:	**Spectrophotometers**	Block diagrams of instrumentation

Part of Final Exam.

Chapter 14:	**Fundamentals of Electrochemistry**	Redox, potentials and cells
Chapter 15:	**Electrodes and Potentiometry**	Indicator and Reference electrodes
Chapter 16:	**Redox Titrations**	Titration curves and applications
Chapter 23:	**An Introduction to Analytical Separations**	Chromatography overview
Chapter 24:	**Gas Chromatography**	Gas Chromatography overview
Chapter 24:	**HPLC**	HPLC overview

Laboratory Schedule

Text: Procedures in Quantitative Analysis, Dahl et al.

All laboratory assignments will be discussed on video lectures and data will be distributed as needed.

Date:	TOPIC
June 10	Lab Safety
June 15	Excel Spreadsheet Calculations and Graphing
June 18	Determination of Soda Ash using HCl
June 22	Potentiometric Analysis of a Phosphoric and Sulfuric Acid Mixture
June 25	**Lab report to be written describing procedural detail: Information will be given!**
June 29	*****Spectrophotometric Analysis of a Permanganate-Dichromate Mixture

Chem 330 Laboratory
Excel Spreadsheet Exercise: Calculations/Graphing

The intent of these exercises is to familiarize yourself with the use of a spreadsheet and to be able to graph various types of data. The program we will use is excel.

A. Prepare a plot of Density of water vs Temperature.

Referring to the handout, reproduce the spreadsheet and corresponding graph as shown. Additionally, generate the best-fit equation for the data obtained. To obtain the equation use *a third-order polynomial* fit and selecting *4* significant digits.

B. pH dependance on the solubility of HgS in water.

Reproduce and complete the spreadsheet below and generate graphs as requested in Part B "Turn in;"

	pH	[H+]	[OH-]	[Hg2+]	[S2-]	[HS-]	[H2S]	C.B. Error	lg[Hg2+]	lg[S2-]	lg[HS-]	lg[H2S]
Ksp=	2											
5.00E-54	3											
Kb_1=	4											
0.9	5											
Kb_2=	6											
1.10E-07	7											
Kw=	8											
1.00E-14	9											
	10											

Formulas

Turn in:

Part A: -Spreadsheet calculation
-Graph
-Best-fit equation and correlation coefficient (r)

Part B: -Spreadsheet calculation
-Graph (Fig 9-3)
-Graph Charge Balance Error vs pH
- report pH at 0 error; **This is the solubility!**

	A	B	C	D	E	F	G	H
1	Calculating Density of H2O with Equation 2-4							
2	(from the delightful book by Dan Harris)							
3								
4	Constants:	Temp (C)	Density (g/mL)					
5	a0 =	5	0.99997					
6	0.99989	10	0.99970					
7	a1 =	15	0.99911					
8	5.3322E-05	20	0.99821					
9	a2 =	25	0.99705					
10	–7.5899E-06	30	0.99565					
11	a3 =	35	0.99403					
12	3.6719E-08	40	0.99223					
13								
14	Formula:							
15	C5 = $A$6+$A$8*B5+$A$10*B5^2+$A$12*B5^3							
16								
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