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. Laboratory meets four and one-half hours per week. (Fall, Spring, Summer)

Course Information

Lecture:	**M- F**	**9:00 am - 11:30 pm**	**Snell Hall 3106**
Lab:	**T,W,R**	**12:30 am – 5:00 pm**	**OCH 3009**

Professor: Dr. Darwin Dahl Office: COOH 2111 Phone: 5074
Office hours: TBA

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.
- Enter the key code: _____(to be given)
- Review the system requirements and confirm that Flash is updated and enabled in your browser.
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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:

Three hour exams will be given during the semester. A comprehensive final exam will be given and will consist of the ACS Standardized Exam. The following grading policy will be followed:

3 hour exams	**40%**
Homework (Sapling assignments)	**10%**
6 Laboratory experiments	**35%**
Final exam (comprehensive)	**15%**

Projected grading scale:

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

The deadline for laboratory reports will be 1 week after completion of the experiment unless otherwise stated. A penalty of **5% per day** will result for reports turned in late. The procedure for submitting reports will be reviewed in class.

Absences

No make-up examinations or Labs will be scheduled.

Significant Dates:

June 3	**Class begins**
June 10	**EXAM I**
June 18	**EXAM II**
June 25	**EXAM III**
June 28	**FINAL EXAM [9:00 am – 11:00] ACS EXAM**

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. University Attendance Policy: Registration in a course obligates the student to be regular and punctual in class attendance. Excessive absenteeism frequently contributes to poor academic achievement. Excessive absenteeism may result in the instructor's dismissing the student from the class and recording a failing grade, unless the student officially withdraws from the class before the withdrawal deadline. http://www.wku.edu/undergraduatecatalog/

CHEM 330 Course Attendance Policy: Attendance is mandatory.

D. 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 3:	**Experimental Error**	Types of Error and Propagation of.
Chapter 4:	**Statistics**	Statistical treatment of errors

Exam II Material

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
Chapter 12:	**EDTA Titrations**	Complex-formation reactions, EDTA equilibria and applications

Exam III Material

Chapter 18:	**Fundamentals of Spectrometry**	Electromagnetic radiation, spectrum
Chapter 19:	**Applications of Spectrophotometry**	Applications
Chapter 20:	**Spectrophotometers**	Block diagrams of instrumentation
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

Part of Final Exam.

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.

Laboratory Experiments will be located in Blackboard!

Note: Prior to lecture on the day of your scheduled experiment, obtain the necessary standard or unknown and place in the oven to dry. Make sure and record the **unknown #** in your laboratory notebook! ***You will need to provide your own safety glasses/goggles..***

Lab: TWR 12:30 - 5:00 pm OCH Room 3009

Date:	**TOPIC**
June 5	Check-in and Glassware Calibration
June 6	Excel Spreadsheet Calculations and Graphing
June 11, 12	Determination of Soda Ash using HCl
June 13	* Potentiometric Analysis of a Phosphoric and Sulfuric Acid Mixture
June 18,19	Complexometric Titration of MgO with EDTA
June 20	*** Ion-exchange lab "Self-developed" Formal Report.**
June 25	*****Spectrophotometric Analysis of a Permanganate-Dichromate Mixture
June 26	*****Alcohol Determination by Gas Chromatography and **Checkout.**

*** denotes working with a partner!**

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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