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<b>Instructor:</b>	David Green
<b>Office:</b>	RAC 128 Ext. 4355
<b>Office Hours:</b>	Tuesday 11-12; Wednesday 2-3; Friday 9:30-10:30; email office hours: all day until 10:00 pm
<b>E-mail:</b>	david.green@pepperdine.edu
<b>URL:</b>	http://seaver-faculty.pepperdine.edu/dgreen
<b>Lecture:</b>	MWTh 12-12:50 p.m. KSC 430
<b>Lab:</b>	PreLab Thursday, 2 p.m.; Thursday, 3 p.m., Friday 9 a.m. KSC 430
<b>Text:</b>	Skoog, West, Holler Crouch, <i>Fundamentals of Analytical Chemistry</i> , 9th Ed. (You may use the 8 <sup>th</sup> edition but homework problems are taken from the 9 <sup>th</sup> edition.)
<b>Lab:</b>	Green, <i>Laboratory Manual to Accompany Quantitative Chemistry and Instrumental Analysis</i>

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**TENTATIVE TEST SCHEDULE**

This schedule is subject to change due to unforeseen factors.  
Chapters tested will include only those covered to the exam date  
and will include laboratory material.

Exam 1	Thur, Sept 26	
Exam 2	Thur, Oct 31	
Exam 3	Tue, Dec 10	10:30-1:00 p.m.

**LEARNING OUTCOMES** The specific Learning Outcomes aligned to the Chemistry program learning outcomes is that at the end of this course participants will be able to successfully solve a variety of multi-step problems using mathematical and descriptive algorithms and critical evaluation of the quality or usefulness of data presented must be considered and explained. Specifically in the laboratory portion of the course, participants will produce reports of independently obtained laboratory results and analyses which must be presented in the scientific format, include journal-type manuscript, monograph, and one-page client-reports.

**GOALS & OBJECTIVES** The overall goal of this course is to provide students with a sufficient understanding of the principles, laws, and theories of analytical chemistry to enable them to successfully analyze real samples using selected classical and instrumental methods. The student should gain the competence to follow a standard procedure, operate the equipment in a safe manner, collect suitable data, evaluate the reliability of the data collected, and report the results in an appropriate form as would be required of any competent laboratory technician. Analysis of small samples is emphasized using methods such as titrimetry, gravimetry, spectrophotometry, and chromatography. Statistical analysis of experimental results is emphasized as well as a in-depth discussion of chemical equilibria and the effect of competing chemical processes on the quality of analytical results.

While the major foci are on the principles and capabilities of selected analytical methods and techniques, the specific goals are that every participant will...

- ✓ recognize and appreciate the value of the analytical instruments used, as well as their limitations, in the solution of selected problems faced by the technician.
- ✓ realize the existence of a variety of analytical methods, each with its own particular capabilities and limitations.
- ✓ understand that the selection of one method as being superior to another in the solution of a particular analytical problem, is based on such factors as sensitivity, time required, selectivity, the economics involved, etc.

- ✓ understand that the success of any of the analytical methods used depends upon a working knowledge and control of the chemical reactions, operating parameters, accuracy and precision required, and time available.
- ✓ be instilled with quantitative analytical habits and skills that, in spite of possibly never performing a specific analysis from this course again, will be valuable regardless of the scientific field the participant may end up in.

This course is nearly entirely a course in applied chemistry. Because of this characteristic, students must come to the course with the foundational knowledge expected to have been mastered in General Chemistry. Theoretical and fundamental topics will also be discussed which will expand on areas introduced in General Chemistry. While coursework beyond General Chemistry is not required to enter this course, it is essential that participants in this course not be intimidated from pursuing background or ancillary information necessary to fully understand a topic.

Upon successful completion of this course every course participant should be able to:

- ✓ demonstrate the meticulous quantitative analytical skills necessary to perform accurate chemical analysis.
- ✓ properly report analytical results with appropriate statistical analysis and confidence.
- ✓ carry out calibration, preparation of a sample for analysis, safe handling of the sample during the analysis, and proper disposal of the sample after completion of the analysis.
- ✓ use techniques for recording and evaluating analytical data.
- ✓ solve a variety of numerical problems dealing with the analysis of samples using computers and a variety of different software packages.
- ✓ write in scientific format reports of the theory, experimental method, and results of an analysis.

## RELATIONSHIP TO THE SEAVER COLLEGE MISSION

From The Mission of Seaver College of Peppercorn University: *“Seaver College exists to provide a link between the knowledge and wisdom of the past and present with the challenges of the future. The college is essentially a community...[of] teachers committed to a life of instruction and scholarship [and] students preparing to assume responsible roles in contemporary society....”*

This course is designed to provide the framework on which hangs a significant portion of the body of basic analytical chemistry, allowing the perceptive participant to glance into the richness of the microscopic world from a macroscopic point of view, and to provide the foundation for further studies in precision chemistry and chemical instrumentation. Over the course of the semester, the successful participant will develop new and expand upon existing skills in critical thinking, analysis and the scientific method. Since chemistry is by its very nature an experimental science, honesty and integrity in the acquisition and analysis of data is at the very core of the scientific process. It is part of our role as practicing scientists to defend the nature of scientific discourse and to expose pseudoscience and scientific dishonesty.

## ATTENDANCE

Generally, roll will not be taken. However, since the content of exams and homework problems is often covered in lecture and lab, missing class is not advised. Chronic absences may result in a grade penalty. Tardiness is disruptive – please try to be to class on time. If you *must* leave early, advise Dr. Green before class starts.

## HOMEWORK

Homework will be assigned as we go. Most of the chapter homework assigned will not be graded. This is because the instructor believes you are in college to learn as much as possible -- not only material for the tests (see also **A Note On Grades**). **You should work as many of the chapter problems as possible beyond those assigned** to achieve the best results in mastering the material, developing intuition and creativity, and personal accomplishment. DO NOT try to do the problems until you have read the chapter at least once completely.

**EXAMINATIONS** Three exams will be given. Unless there are extreme circumstances, no test may be taken early or late. Each test counts 100 points. If you score below 65% on two exams, please see Dr. Green concerning your status in the course. There is no mechanism built into the class to make up a missed exam. Make arrangements early if you will be missing an exam because you are a participant in a school sponsored event. In the event of an illness – with documentation from a physician or the University Health Center – contact the course instructor as soon as is practical to make appropriate arrangements. A tentative exam schedule is given below.

**QUIZZES** Occasional unannounced short quizzes may be given during the semester so that you can track your progress and improve on deficiencies if necessary. If you miss a quiz for any reason, it cannot be made up.

**DEADLINES** Deadlines and due-dates are not negotiable. It is the responsibility of every student to meet due date deadlines., Quizzes and exams must be turned in when called for. Competency, mastery and success in any course (or career choice) is defined not only by the correct answer but by a person's alacrity, facility, and finesse at completing timed tasks.

**GRADING** **It is important to remember that grades are not wages.** You will not be graded on how hard you work – you will be graded on mastery of the assigned material. Your course grade is broken down as follows:

3 tests @ 100 pts.	=	300 pts
Homework	=	30
Discretionary	=	20
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		350 pts

**CURVING** You may be accustomed to being "graded on a curve" in some of your classes. What is usually meant by this is that if an average test score is not at an arbitrarily determined level, the teacher will adjust the scores or grade range-breaks so that the average does meet this numerical criterion. It makes little statistical sense (on which a *curve* depends) to curve a class of less than 50-100 students. A curve also tends to promote unhealthy competition which interferes with an atmosphere of cooperativity and friendly competition. In this course your grade will be based on your final course average and determined by a fixed scale:

Course Average	Grade
100-94%	A
90-93%	A-
87-89%	B+
84-86%	B
80-83%	B-
77-79%	C+
74-76%	C
70-73%	C-
etc.	

Scores on the borderline will be handled individually by the instructor. *Borderline* is defined as being 0.45 percentage points from the next highest grade.

**OFFICE HOURS** Office hours are posted. Attending posted office hours are preferred but if you can't make a posted hour you can make an appointment or even just try dropping by. **Don't hesitate to get help if there's a problem.** If you are doing unassigned problems to gain proficiency, I will go over the problem with you if you wish. You may use e-mail to get non-immediate help as well. The professor's e-mail address is given above.

**A Word On DEAD WEEK** Contrary to common belief, the last week of classes is not reserved for review, partying, etc. There will be lecture on new material and assignments will be due. There might be review during that week as well.

**A Word On Sorority,  
Fraternity, Sports,  
etc.**

Extracurricular activities such as debate, volunteering, community service, sororities, fraternities, athletics, drama and other artistic endeavors, etc. are important parts of your total education at Pepperdine. However, these activities require a very significant time commitment. **It is your responsibility to keep up in class while involved in extracurricular activities.**

**PLAGIARISM  
AND  
CHEATING**

Fortunately, in all likelihood, no one in this class will be subject this paragraph. Plagiarism and cheating are professionally and ethically wrong. Academic integrity is violated when one of the following events occurs: plagiarism, cheating, fabrication, or facilitating academic dishonesty. There exists a fundamental difference between working cooperatively (e.g. working together with friends or in a study group on homework problems and laboratory exercises which this instructor not only approves of but also recommends) and simply copying someone else's work. Academic and professional dishonesty are offenses of considerable magnitude. Careers have been brought to a close over a single incident. Students suspected of breeches of academic dishonesty will be referred to the University Academic Ethics Committee. **Students suspected of cheating or plagiarism will be referred to the University Academic Ethics Committee. It's not worth it – trust me on this!**

(See also <http://seaver.pepperdine.edu/academicintegrity/policies/violations.htm>)

**CELLULAR  
TELEPHONES,  
and SOCIAL  
MEDIA**

If you bring a cell phone with you to class, please turn it off or deactivate any audible signals before class starts. It is very distracting (and stunningly inconsiderate) to have incoming calls during class time. Some like to use their computer to take notes in class – a practice which your professor does not discourage. There is a strong temptation to interact through social media during class – a practice which your professor strongly discourages. **Your course grade will be adversely affected if your phone audibly rings or if you are found to be texting or using social media during class.**

**IMPORTANT  
INFORMATION  
THAT DOESN'T FIT  
ELSEWHERE**

The incomplete grade (I) will be assigned only in cases of an extreme emergencies and only in the last 3 weeks of class (after Exam 3 but prior to the final exam). According to university policies, the grade of incomplete will not be assigned to allow extra time for a student improve their grade but, rather, only in the case where an emergency prevents a student from completing a course's culminating assignments and exams. Supporting documentation is required. Should the need arise for non-emergency situations, there are 3 opportunities during the semester to withdraw from this course.

There is no "extra credit". No exceptions; please, don't ask. Consider the rationale: If someone hasn't yet earned the available credit, how then can they be eligible for "extra credit"?

Some Pet Peeves: There are really very few things that bother this professor during class time. An open and friendly classroom that allows for discussion and dialog is desired and, even, encouraged. However, there are a few behaviors that can elicit a strong and negative response. The chances of getting along with this and other professors are greatly increased if you avoid...

...continued chatter past the scheduled start of class time.

...talking when the instructor is talking or someone is asking a question or speaking.

...habitually arriving late to class.

...chronically leaving and returning to the classroom during lectures.

...making any noise while chewing gum.

...eating loud food or slurping through a straw during lectures.

...failing to laugh at your professor's jokes regardless of their humorous quality.

**SAVING GRADED  
MATERIAL**

It is your responsibility to save all graded materials (exams, homework, etc.) for this class. As per university policies, all grade disputes must be settled by the midpoint of the next non-summer semester which immediately follows this course.

## **COUNSELING CENTER and DISABILITY SERVICES**

Students who feel that they may suffer from “test anxiety” or other academic obstacles despite exercising reasonable study and social habits may benefit by speaking to one of the staff in the Counseling Center.

Any student with a documented disability (physical, learning, or psychological) needing academic accommodations should contact the Disability Services Office (TCC264, x6500) as early in the semester as possible. All discussions will remain confidential. Visit [www.pepperdine.edu/disabilityservices/](http://www.pepperdine.edu/disabilityservices/) for additional information.

## **COURSE EVALUATIONS**

At the end of every course, each student has the opportunity to evaluate the course and the professor. This input is valuable for every faculty member so that they can discern both what is being well-presented as well as what may need to be modified to improve the course. Course evaluations are completed on-line near the end of the semester.

Your professor in this class appreciates your critique, both good and bad, and believes that you do not need to be motivated to complete your evaluation by receiving “extra credit” points or other intangible rewards.

## **LABORATORY**

You are required to attend prelab discussion and laboratory at the assigned time. The lab is scheduled for 4 hours. You will undoubtedly, at times, take longer than 4 hours. You will have some opportunity to work on your laboratory assignments at other times as well if you are not finished by 6 p.m. This offer of extra time does not extend to those who leave with the intention to come back later to finish – it is only offered to those who actually work during the assigned 4 hours and cannot complete the lab on time. I will give time-saving hints when they are available and appropriate (and don't adversely affect the analysis or experiment). **If you miss more than 3 labs, a lab grade of 'F' will be assigned.** Please don't miss lab. **The laboratory grade is independent of the course grade.**

For analyses and experiments which require a formal report, you will have 2 weeks from the time you complete an analysis to turn in the analysis report without penalty. If you turn the report in within 1 week of the day the analysis is assigned, an additional 10% will be added to the report score. If you turn in the report after 2 weeks, a non-negotiable 10% late penalty will be assessed per day (or any part thereof). It is essential that you do not get behind in turning laboratory reports!

Since the laboratory complements the lecture, you will be responsible for laboratory material in lecture.

## **INTELLECTUAL PROPERTY STATEMENT**

Course materials prepared by the instructor, together with the content of all lectures and review sessions presented by the instructor, are the property of the instructor. Video and audio recording of lectures and review sessions without the consent of the instructor is prohibited. Unless explicit permission is obtained from the instructor, recordings of lectures and review sessions may not be modified and must not be transferred or transmitted to any other person. Electronic devices other than calculators (e.g., laptops, cell phones, PDAs, calculators, and recording devices) are not to be used during lectures or exams without prior permission of the instructor.

## **PARTING NOTE**

If you are having any problems in the class, do not hesitate to come see me (this applies equally to out-of-class problems). I will attempt to accommodate the best I can if you need help outside of office hours.

## Some Important Dates

8/30/2017	Last day of add/drop period
9/2/2017	Labor Day holiday. <b>Laboratory is affected.</b>
9/9/2017	Last day to change CR/NC status
10/4/2017	Faculty Conference. <b>Laboratory is affected.</b>
10/21/2017	Last day to withdraw with a grade of W
11/27/2017	Thanksgiving holiday. <b>Laboratory is affected.</b>
12/2/2017	Last day to withdraw with a grade of WP/WF
12/9/2017	Final exams

## A Note On Grades

Most students believe their course grade is important, and rightly so. However, many will try to "earn" an 'A' with a minimum amount of work, or with procrastination, cramming, etc., and perhaps even cheating. One goal of this instructor is to help you make the attainment of knowledge (not just chemistry) and its wise use your ambition. When you make learning *personal* and not simply a short-term goal to get you to the next class, job, etc. then the grade will have a new significance and be a by-product of (rather than) the goal. With this in mind, the guidelines for the definition of the course grade is outlined below. The will be the criteria used to determine your course grade.

**A** is the highest academic grade possible. This honor is **not** automatically given to a student who ranks highest in the course, but is reserved for accomplishment that is truly distinctive and demonstrably outstanding. It represents a superior mastery of course material and is a grade that demands a very high degree of understanding, originality, and/or creativity. Further, the student is characterized as one who takes initiative in seeking new knowledge outside the formal confines of the course.

**B** is a grade that denotes achievement considerably above acceptable standards. Good mastery of course material is evident and student performance demonstrates a high degree of originality, creativity, or both. Student works well independently and often shows initiative. Oral and written analysis, synthesis, and critical expression is considerably above average.

**C** indicates a satisfactory degree of attainment and is the acceptable standard for proceeding to more advanced work in the field. It is the grade that may be expected of a student of average ability who gives to the work a reasonable amount of time and effort. This grade implies familiarity with the content of the course and acceptable mastery of the material. Student displays some evidence of originality, creativity, or both. Student works independently at an acceptable level and **completes all requirements in the course**, including attendance and participation.

**D** denotes a limited understanding of the subject, meeting only the minimum requirements for passing the course. It signifies work which in quality and/or quantity falls below the average acceptable standard for the course. Performance is deficient in analysis, synthesis, and critical expression and lacks in originality and creativity. This grade is insufficient to proceed to higher level courses in the discipline. For most students this grade is the result of insufficient devotion of time to the course.

**F** indicates inadequate or unsatisfactory attainment and a serious deficiency in understanding of material. This grade also indicates the student cannot work independently and/or fails to complete assignments. This grade is usually earned by students who do not attend class or devote sufficient time to study. This grade, like the 'D', is inadequate for proceeding to higher level courses in the field.

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## Generally Observed Student Characteristics

(Adapted from John H. Williams, *The Teaching Professor*, 1993, pp 1-2)

### The "A" Students...

<b>Attendance</b>	...have nearly perfect attendance.
<b>Preparation</b>	...are prepared for class. Their attention to detail is superb and they usually read the material prior to class.
<b>Curiosity</b>	...show a high level of interest in the subject matter whether they actually like the subject or not. They look up or search out answers to topics that they don't understand. They often ask interesting questions or make insightful comments.
<b>Retention</b>	...are able to retain new material and consciously connect past learning to the present.
<b>Attitude</b>	...have an attitude that displays both the determination and self-discipline required for success. They also show initiative and do things without being told.
<b>Talent</b>	...possess a special talent. It may be exceptional intelligence and insight or it may be unusual creativity, organizational skills, commitment and perseverance - or a combination thereof. These gifts are evident to the professor and usually to the other students as well.
<b>Results</b>	...make the highest grades on tests and their work is generally a pleasure to grade.

## The "C" Students...

<b>Attendance</b>	... put other priorities ahead of academic work and may miss class frequently.
<b>Preparation</b>	...prepare their assignments consistently, but in a perfunctory manner. Their work may be sloppy or careless and at times is incomplete or late.
<b>Attitude</b>	...are not visibly committed to the class. They participate, if at all, without enthusiasm and their body language often expresses boredom.
<b>Talent</b>	...vary enormously in talent. Some have exceptional ability, but show undeniable signs of poor self-management or bad attitude. Other are committed and diligent, but are simply average in academic ability.
<b>Results</b>	...obtain mediocre or inconsistent results on tests. They have some concept of and familiarity with the material, but clearly do not show mastery of the subject matter while insisting otherwise.

## A Guide to Learning

The following taxonomy<sup>1</sup> summarizes the 6 levels of learning. Generally, it may be said that a student who wishes to master the material of a class will strive to reach level 6.

Notice that to move up in the learning hierarchy, a student will have, for example, mastered the language of the field and possess a knowledge-base of basic facts before they can select the correct formula to solve a problem given a list of data. A level 6 "thinker" will necessarily have mastered the lower levels to such an extent that they can call upon those tools as necessary to solve the problem at hand. It is suggested that one cannot effectively move to higher levels until lower levels have been adequately addressed.

1. **Knowledge** Language of chemistry, nomenclature, facts, memorization
2. **Comprehension** Qualitatively predict outcome of a reaction or process, summarize results, estimate a result
3. **Application** Use formulas to solve a problem ( $d=m/v$ ,  $PV=nRT$ , etc.), apply and calculate, algebraic manipulation, explain and demonstrate
4. **Analysis** Gather and use experimental data to solve an assigned problem, present results in written or oral format
5. **Synthesis** Use prior knowledge to derive new knowledge, derive from known equations new and useful equations, utilize prior material learned in prior courses in current course, read the primary and secondary literature to obtain necessary tools for performing an experiment, independently design a new experiment or analysis, gather and use experimental data to solve a problem, write and speak clearly and accurately in the scientific style
6. **Evaluation** Examine data and results to distinguish quality from "noise", read the primary literature and rationally and critically discuss the results presented, predict the outcome of similar experiments

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<sup>1</sup>This hierarchy is based on Bloom's Taxonomy of Cognitive Learning



## Quantitative Chemistry Chapter Schedule

This schedule gives the minimum content we will cover in each chapter. Some chapters not listed here may be covered as a part of pre-lab lecture.

Chapter	Coverage
1	<b>Introduction</b> Classification of analytical methods Basics of analytical design and selecting a method
2-4	<b>Tools of Analytical Chemistry</b> Reagent and sample handling The laboratory notebook Chemical and formula stoichiometry
5,6	<b>“Error” in Chemical Analysis I</b> Definition of terms Systematic vs. random errors Statistical treatment of error Standard deviation Reporting data
7,8	<b>“Error” in Chemical Analysis II</b> Statistical confidence Hypothesis testing Detection limit Least-squares fit
9,15	<b>Equilibrium I: Aqueous Solution Chemistry</b> Basic acid-base chemical equilibrium Systematic approach to equilibrium Buffer systems Titration curves
13,14,16	<b>Titrimetric Methods of Analysis</b> Definition of terms Stoichiometric calculations Introduction to different techniques
11	<b>Equilibrium II: Complex Equilibria</b> Application of the systematic method Polyprotic acids/polybasic bases
10,12,17	<b>Equilibrium III: Solubility Equilibria</b> Simple equilibria Complex equilibria Fractional precipitation Precipitation under pH control
30	<b>Introduction to Separation Science</b> Definition of terms Migration of solutes Band broadening and column efficiency Resolution
32	<b>Applications of Separation Science: HPLC</b> Instrumental considerations Types of HPLC separations Detection systems Design of a separation Applications of HPLC
31	<b>Applications of Separation Science: GC</b> Instrumental considerations The GC column Detection systems Design of a separation Applications of GC

## **Disclosure Statement Required by the State of California**

Regulatory Notice: Natural Science Division laboratories contain, and certain class experiments or procedures will expose you to, chemicals known to the state of California to cause cancer, birth defects, and other reproductive harm at levels which require a warning. For more information, contact your instructor or the Office of Insurance and Risk Management at extension 4702.

So... there.

## Tips to Better Scores on Homework, Quizzes, Exams, and Laboratory Reports

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Excellence in presentation and attention to details are some evidences of mastery and comfort in a field of study. When working class and laboratory assignments, please attempt to conform to the following guidelines to receive the maximum possible credit:

- All work must be legible.
- All numerical values that are not pure counting numbers must have units (e.g., 1.23 m, 4.5 g)
- Do not improvise units. (e.g., 1.23 m is 1.23 meters. The 'm' means meters, not moles, molecules, miles, etc. Kilograms are kg not Kg, etc.)
- Avoid assigning units as variables. (e.g., the equation  $d = \frac{m}{V}$  should generally not be written with the variables assigned the units:  $d = \frac{g}{mL}$ )
- A solution to a problem should be logically presented and algebraically consistent. For example, a two step problem might be presented as follows:  
Calculate the mass, in milligrams, of 2.5 mL of water (density = 1.00 g/mL)

$$m = 2.5 \text{ mL} \times 1.00 \frac{\text{g}}{\text{mL}} = 2.5 \text{ g H}_2\text{O}$$

$$m = 2.5 \text{ g H}_2\text{O} \times \frac{1000 \text{ mg}}{\text{g}} = 2,500 \text{ mg H}_2\text{O}$$

or

$$m = 2.5 \text{ mL} \times 1.00 \frac{\text{g}}{\text{mL}} \times \frac{1000 \text{ mg}}{\text{g}} = 2,500 \text{ mg H}_2\text{O}$$

but not

$$m = 2.5 \text{ mL} \times 1.00 \frac{\text{g}}{\text{mL}} = 2.5 \text{ g H}_2\text{O} \times \frac{1000 \text{ mg}}{\text{g}} = 2,500 \text{ mg H}_2\text{O}$$

- Avoid round-off errors in intermediate calculations.
- Use a leading zero in fractional decimal figures less than 1. Often the decimal point is not seen by the grader (e.g., 0.123 g not .123 g)
- When graphing, use a graphing program or spreadsheet program for best presentation.
- Use the proper form in writing chemical symbols. (e.g., sodium is Na not NA; platinum is Pt not PT.)
- Write exponential notation correctly: 13240 m is  $1.324 \times 10^5$ , not 1.324E5 or (gasp!) 1.324<sup>5</sup>. Some instructors don't care: yours does.
- The names of chemical compounds are not proper nouns unless they are trade names. (e.g., sodium chloride not Sodium Chloride; potassium sulfate not Potassium Sulfate; etc.)

## Homework Assignments (not necessarily exclusive)

Chapter	Problems	Due Date
1,2,3	None	
5	8,9,12bd,13abc	
6	7abc,8abc,9abde,11bd,13,15	
7	4ab,5ab,6ab,8,14,16,22,34a-f	
8	4,15a-e,17ab,19,21	
4	4,9-11,13,15,16,18ab,19ab,21,24a-f,31a-d,34	
13	3,10,16,22-25	
9	Set 1: 4abd,7a-e, 20abceg,24,26,27,29,30	
14	8,13,17ab,24ac,32ac,41a,42a	
15	5abc,9bd,12b,16,21,26a	
9	Set 2: 10ab-12ab,13,15	
11	7a,14,18( $\beta_2 = K_f$ ), Additional Problem: calculate the approximate solubility of barium oxalate in pure water.	
10	9ac,12ab, Chap14:31	
16	4,8,14ab,16cd,19,20,25,32	
12	5,6,7,10,12,18,21,28	
31	5,24,28,34b-h	
33	2abdeg,4,8	