Advanced Analytical Chemistry
CHEM 3220 (CRN 3079)
Fall Quarter, 2013

Instructor: Dr. J. Alex Huffman
Office: SGM 180
Contact Info: phone – (303) 871-4404; email – alex.huffman@du.edu

Class Time: MWF, 10:00 – 10:50 AM
Class Location: Olin 103
Office Hours: None specifically posted / open door policy.

REQUIRED COURSE ITEMS

Textbook: (1) *Mass Spectrometry: Principles and Applications* (~$50 on Amazon)
Edmond de Hoffmann and Vincent Stroobant, 3rd Edition, 2007
(-) Additional reading materials will be scanned and distributed via Blackboard

COURSE DESCRIPTION

Advanced Analytical Chemistry is a graduate/upper division course and will combine portions of lecture with independent learning expected of advanced students. The course is somewhat of an overview of instrumental techniques widely utilized by chemists, but we will not have time in ten weeks to go in great detail in many area. As a result of this limited time frame we will focus on a few selected areas to varying depths, but the course will focus most heavily on aspects of mass spectrometry (MS).

Whether your career path is one towards research, teaching, industry, or some other area of science, your marketability will depend on both your knowledge and your skill. Thus, the over-arching goals of this course are to further your knowledge of analytical chemistry and instrumentation as well as to help you practice your critical and independent thinking skills. You will not always be told exactly what you need to know, but you will be given resources in order to help you make a reasoned decision and choose an appropriate path.

COURSE PRE-REQUISITES

The pre-requisites officially listed in the course catalog are CHEM 2011 (Analysis of Equilibrium Systems) and CHEM 3621 (Physical Chemistry III). However, in addition to these it is highly recommended that all student take CHEM 3210 (Instrumental Analysis) or an equivalent course at another university in advance of this course. Please see Dr. Huffman within the first week if this is not the case.

COURSE STRUCTURE & FORMAT

The format of our meetings will follow a traditional lecture format; we may also arrange a field trip to a local commercial MS facility. The lecture plan will be comprised of the following modules (in unequal measures):

1) The analytical process and general instrument basics
2) Fundamental chromatography
3) Mass spectrometry
4) Data analysis techniques
5) Surface characterization techniques (time-permitting)

Not all skill scan be passed on via lecture and homework or tested via examination. Other critical skills for young scientists will be developed in this course, including:

1) Literature searching
2) Scientific presentation
3) Idea generation

OFFICE HOURS
I have found that for the limited number of students in this course, it is easier to keep an open office door policy rather than post specific office hour times. Feel free to come to my office and talk to me about any aspect of the course, or issues beyond. I will be happy to provide my perspective and advice wherever helpful. You may find it easier to email me ahead of time to make sure I'll be available when you come by.

Depending on your personality and background, coming to instructor office hours may be uncomfortable. Please know that I am happy to talk to you individually, and you do not need to wait until you have a major problem before coming to my office. You are welcome to come by and discuss at any time.

READING
Most lectures will have associated reading assignments. A tentative/preliminary lecture and reading schedule is listed at the end of this syllabus. Outside of the readings from the de Hoffmann text, assigned reading materials will be made available on the blackboard site. You are expected to compete the assigned reading prior to the class lecture in most cases. Not all reading material will be discussed directly in lecture. However, the listed reading assignments are often long and reading all sections in great detail will not always be required. Some of this material will be useful as reference for assignments and for possible future use. We will discuss which reading sections can be skimmed as the quarter progresses.

GRADED ASSIGNMENTS
Assignments will be given periodically throughout the course. Problem-solving is an important component of all chemistry and most science courses. For most students, successfully solving problems requires practice. The given assignments will be designed to highlight important ideas and concepts, but will not necessarily reflect all types of problems you may encounter on an exam or in the real world.

It is okay to discuss assignment problems in small groups. In fact this is encouraged, because it will help you learn (teach each other, bounce ideas, etc.) and is relevant for preparing you for research. However, everyone is responsible for working out, understanding, and writing their own solution separately. If you don't go through the effort of understanding and solving every problem yourself (after discussion if you want) you will find yourself at a large disadvantage in the exams where you have to solve new problems quickly, and you will not take as much away from this course.

Proper written and oral presentation of your thoughts is also a key scientific skill and will be encouraged through this course. It is often a significant problem to "decode" writing on assignments and exams if the work is poorly organized, or if the writing is too small or messy. As such, Dr. Huffman will take points off for poor legibility. Please make an effort to be very clear in your communication, whether verbal or written. Consider the best way to present your information in each case. In some cases typing the assignment may be the most efficient presentation, and in other cases neatly hand-written work will be best.

Please list units of all results in all cases. SI units are generally preferred.

EXAMS
Two (2) exams will be given during the quarter: one mid-term exam (~10%) and one cumulative final exam (~20%). Material chosen for these exams will be taken from lecture, readings, and group presentations. Only in extremely extenuating circumstances, and with required documentation (e.g., letter from Student Health), will a make-up exam be given. Please advise Dr. Huffman as soon as possible (minimum one week) if you will be out of town for a university sanctioned function (e.g. athletic team or music group).

JOURNAL SKIM & ORAL PRESENTATION

One key skill required of research scientists is the ability to keep up-to-date with recent literature. Another ubiquitous skill required of all scientists is the ability to efficiently present scientific work. Students will practice these skills by periodically scanning recent literature and presenting material in two formats. Each of these assignments will be outlined in detail on subsequent assignment sheets and discussed in class:

(1) Over the course of the quarter each student will be required to present two very short synopses of research articles. These will be limited to three minutes in length and will require students to convey only the very central themes of a research article. We will use these opportunities to expand the exposure to different analytical techniques.

(2) Each student will be assigned a group of two students to present a topic as a team. This will require literature research, self-learning, group participation, and presentation skills.

GRADES

Grading is absolute, and not curved. However, grades may be adjusted based on class performance. Grades will only be increased under this situation and never decreased. I will be very happy for everyone to receive an A, however, this grade will only be awarded if earned.

Late assignments will not be graded unless agreed on by Dr. Huffman ahead of time. If they are graded, the grade will be reduced by 30% to discourage lateness. If you cannot come to class a day in which an assignment is due, you can (a) turn it in ahead of time or (b) send the file electronically to Dr. Huffman. In the latter case, make sure files are legible in the format sent and < 7 MB.

Please don't obsess about grades (especially in graduate school)! Indeed they are a measure of output and performance quality, but are much less important than you may often think. Grades should not become an end in themselves (the "professional student syndrome"), rather they should be a feedback tool to help you identify your strengths and weaknesses. You will be given the grade you earn, but historically most students have all done relatively well.

At the end of the quarter, you will be graded according to your performance based on the weighted average of the following course components:

Component	Percentage
Assignments	30%
Exams	30%
Group Presentation	15%
Journal Presentations	10%
Ideas Assignment	10%
Participation and Discussion	5%
Total	*100%*

Grade	Percentage
A	94.0 - 100
A -	88.0 - 94.9
B +	82.0 - 87.9
B	75.0 - 81.9
B -	69.0 - 74.9
C +	62.0 - 68.9
C	56.0 - 61.9
C -	49.0 - 55.9
D +	43.0 - 48.9
D	36.0 - 42.9
D -	30.0 - 35.9
F	< 29.9

ATTENDANCE POLICY

You are required to attend all lectures. However, I realize you are also adults with other life priorities that must be sometimes be balanced. Please do not stress if you need to miss a class lecture. You will be given some grace in attendance, but please notify Dr. Huffman with the reason you have missed a class or if you will need to.

LIBRARY RESOURCES
The University Libraries Research Center answers research questions seven days a week by phone, email, in-person, chat/IM or text. One-on-one research consultations in the Anderson Academic Commons are also available on a drop-in basis or by appointment. Consultations help students at any stage of the research process, from refining a topic, to finding books and articles, to creating a bibliography with RefWorks. Ask a question or make an appointment at 303-871-2905 or research-help@du.edu.

Kathleen Gregory, the science & engineering librarian at Penrose Library, has assembled some useful resources that may be helpful for your literature searches and research: http://libguides.du.edu/chemistry.

CELLULAR PHONE AND MOBILE DEVICE POLICY
I respect the need for each individual to stay in contact with family and friends. The use of mobile devices, however, is disruptive to the learning environment. Thus, I request that the ringers of all cellular phones, pagers, and other mobile devices be muted during class. If an emergency arises, and you need to make a call on your phone, I request that you quietly leave the room and conduct your conversation out in the hallway.

CENTRAL UNIVERSITY POLICY AND RIGHTS
DU affirms: In all that we do, we strive for excellence, innovation, engagement, integrity and inclusiveness.

It is the on-going policy and practice of the University of Denver to provide equal opportunity to all students and employees. No person shall be discriminated against because of race, color, national origin, sex, religion, age, disability, or veteran status.

For more information, or if you feel your rights have been impinged upon, please see the following resources at the Office of Diversity and Equal Opportunity: http://www.du.edu/deo/; or the Office of Student Life: http://www.du.edu/studentlife/**.**

Dr. Huffman takes the effort to increase inclusiveness as a very important personal goal. I would be very happy to talk with you individually about how I and the university can better support you as a student.

RELIGIOUS ACCOMODATIONS
University policy grants students excused absences from class or other organized activities or observance of religious holy days, unless the accommodation would create an undue hardship. Faculty will be responsive to requests when students contact them *in advance* to request such an excused absence. Students are responsible for completing assignments given during their absence, but will be given an opportunity to make up work missed because of religious observance.

It is your responsibility to examine the course syllabus for potential conflicts with holy days and notify Dr. Huffman by the end of the first week of classes of any conflict that may require an absence (including any required additional preparation/travel time). You will also be responsible to make arrangements to make up any missed work or in-class material within a reasonable amount of time.

DISABILITY ACCOMODATIONS
Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please also feel welcomed to contact the Disability Services Program (303-871-2278 / 7432 / 2455) located on the 4th floor of Ruffatto Hall to coordinate reasonable accommodation for your disability or medical issue. For further information, please see their website: http://www.du.edu/disability/dsp/index.html. See the *Handbook for Students with Disabilities.*

ACADEMIC DISHONESTY & STUDENT SUPPORT

While I advocate collaborative learning and teamwork, I also firmly believe that each individual should maintain the highest ethical standards in all of life's endeavors. As such, I support and will strictly enforce the Honor Code of the University of Denver. See links for specific links below:
Pioneer Pledge: http://www.du.edu/studentlife/ccs/pledge.html
Honor Code Statement: http://www.du.edu/studentlife/ccs/honor_code_2011-2012.pdf

I also understand that every student has unique personal and educational needs. I will do my best to help you learn or appropriately facilitate your ability to work through personal issues. Please see the Office of Student Life (http://www.du.edu/studentlife/ccs/index.html), including the Pioneer Care program (http://www.du.edu/studentlife/care/), for more detailed resources.

						Assignments						
Class #	**Week #**	**Date**	**Weekday**	**Section #**	**Topic**	**Assigned**	**Due**	**Topic**	**Reading Assignment**	**Journal Presentations**		**Group Pres.**
1		Sep 9	M	1.1	Syllabus and introductions + Analytical process	Topic request						
2	1	Sep 11	W	1.2	Analytical process + Effective scientific presentations	PS #1 Assigned	Topic request		**Schultz**, Chapters 25 & 26			
3		Sep 13	F	1.3	Presentations discussion + Analytical process		**PS #1 Due**	#1: seminar criticism	**Skoog (PIA)**, Chapter 1			
4		Sep 16	M	1.4	Digital electronics				**Skoog (PIA)**, Chapter 4A - 4E			
5	2	Sep 18	W	1.5	Basic optics	PS #2 Assigned			**Skoog (PIA)**, Chapters 6, 7A - 7F	1		
6		Sep 20	F	2.1	Chromatography introduction				**Braithewaite**, Chapters 1 - 2	2	10	
7		Sep 23	M	2.2	Chromatography	PS #3 Assigned	**PS #2 Due**	#2: basic instruments	-	3		
8	3	Sep 25	W	2.3	Chromatography	PS #4 Assigned			**Skoog (FAC)**, Chapters 34 - 36^	4		
9		Sep 27	F	2.4	Chromatography		**PS #3 Due**	#3: chromatography 1	-	5		
10		Sep 30	M	3.1	Mass spectrometry: intro. and history		**PS #4 Due**	#4: chromatography 2	**de Hoffmann**, Introduction	6	11	
11	4	*Oct 2**	W	E1	**Exam #1**				-			
12		*Oct 4**	F	-	*Kathleen Gregory / Penrose Library: Literature Research*	PS #5 Assigned			-			
13		Oct 7	M	3.2	Ion sources				**de Hoffmann**, Chapter 1^	7		
14	5	Oct 9	W	3.3	Ion sources		**PS #5 Due**	#5: lit. research	-	8		
15		Oct 11	F	3.4	Ion sources / Mass analyzers				**de Hoffmann**, Chapter 2^	9		
16		Oct 14	M	3.5	Mass analyzers		**5 Ideas Due**		-			**Group 1**
17	6	Oct 16	W	3.6	Mass analyzers	PS #6 Assigned			-	1		
18		Oct 18	F	3.7	Mass analyzers				-			**Group 2**
19		*Oct 21**	M	-	*No class / Agilent visit to be scheduled*				-			
20	7	Oct 23	W	3.8	Detectors		**PS #6 Due**	#6: MS 1 - ionization	**de Hoffmann**, Chapter 3^			**Group 3**
21		Oct 25	F	3.9	Tandem MS	PS #7 Assigned			**de Hoffmann**, Chapter 4^	2		
22		Oct 28	M	3.10	MS Interpretation				**de Hoffmann**, Chapters 6 -7^			**Group 4**
23	8	Oct 30	W	3.11	MS Interpretation		**PS #7 Due**	#7: MS 2 - analyzers	-	3		
24		Nov 1	F	3.12	MS Interpretation	PS #8 Assigned			-	4		
25		Nov 4	M	3.13	Analysis of biomolecules				**de Hoffmann**, Chapter 8^	5		
26	9	Nov 6	W	4.1	Error analysis		**PS #8 Due**	#8: MS 3 - Interp.	**Skoog (FAC)**, Ch's 6, 7A - 7C, 8D			**Group 5**
27		Nov 8	F	4.2	Multivariate Analysis				**Taylor**, Ch's 1, 9.1 - 9.4, 12.1 - 12.2	6		
28		Nov 11	M	4.3	Multivariate Analysis	PS #9 Assigned			**Zhang** + **Lochmüller** articles^	7	10	
29	10	Nov 13	W	5.1	Surface analysis techniques		**13 Ideas Due**		**Skoog (PIA)**, Chapter 34	8		
30		Nov 15	F	-	Overflow buffer + Review		**PS #9 Due**	#9: complex analyses	-	9		
31	-	Nov 18	M	E2	**FINAL EXAM - 10:00 - 11:50 AM**				-			

* Dr. Huffman *will* be out of town Sept. 30 (after class) - Oct. 4

* Dr. Huffman *may* be out of tow Oct. 21-22

Textbook Key:

Braithewaite = Chromatographic Methods
de Hoffmann = Mass Spectrometry: Principles and Applications
Schultz = Eloquent Science
Skoog (PIA) = Principles of Instrumental Analysis
Skoog (FAC) = Fundamentals of Analytical Chemistry
Taylor = An Introduction to Error Analysis

^ = entire section(s) not required

CHEM 3220 - Adv. Analytical Chem

Dr. Huffman

Preliminary Schedule - Fall 2013

Fall Quarter 2013

CHEM 3220 – Advanced Analytical Chem.
Dr. Huffman

Journal Skim and Oral Presentation Assignment

Almost anyone can give a long presentation, especially on your own work, but you rarely have the opportunity. It is much more important to be able to communicate your key ideas *quickly*. In this assignment, each student will be required to individually perform two *extremely short* (3 min.) oral presentations, each briefly summarizing a paper highlighting a new analytical technique. The purpose of this assignment is to: (a) provide the class exposure to topics and techniques beyond what we can address in the ten-week quarter and to develop your skills of: (b) distilling and presenting information key pieces of information quickly, and (c) skimming recent literature for interesting material.

Choose two articles (new article for each presentation)**:**

- That highlight a chemical technique or instrument development
- From last 5-years (2008-2013)
- From among three journals:
    - *Analytical Chemistry*
    - *Analytical and Bioanalytical Chemistry*
    - *Trends in Analytical Chemistry*

Presentation Details:

- Simple: "3 slides in 3 minutes"
    - Slide 0 = Your name, date + Paper tile, authors, affiliations, citation/reference
    - Slide 1 = Background / context (Why did they develop a new technique? / What contribution does the advancement provide to the scientific community?)
    - Slide 2 = What is the technique? / How does the technique work?
    - Slide 3 = How and to what did they apply the technique?
- Don't waste time; be crisp. Remember this is a very short presentation, and may be more difficult than you expect. But don't just talk faster to fit in more words. Instead, consider how to distill the key information in the paper into a form that your peers will understand and learn from.
- Don't try to present all the information in the paper. Focus on the key messages and purpose.
- Briefly say why you chose this paper (1-2 sentences)
- Few/no questions will follow this talk, and nothing specific is required of listeners
- You do not need to turn in a written report associated with these presentations
- Material from these presentations will not be reflected on the final exam

General steps/requirements:

1. Paper approval (the earlier the better):
    - Email Dr. Huffman a copy of the paper a *minimum* of 1-week before presentation.
    - Include ~1 summary sentence and another about why you think the paper is appropriate.
    - Remember that the paper must highlight a new technique or method and must fit the requirements listed above. Be aware I occasionally ask students to choose another paper.
2. Email a .pdf (Adobe) version of your paper to the class at least 72-hours before your presentation.
    - Each member of the class will be responsible for reading the abstract and conclusions, as well as familiarizing yourself with the figures. This is a good skill to practice, because you will never have time to read all the papers in full that people suggest for you.
3. Email Dr. Huffman a copy of your presentation slides (.ppt, .pptx, or .pdf) by 9 AM the day of your presentation so I can load it onto my computer.
4. Presentations will usually take place at the beginning of class.

Presentation grade break-down/rubric *(preliminary)*:
Journal presentations score will account for 10% of the final course grade

Content (*27.5 pts*)
- Appropriate article choice (*2.5 pts*)
- Slide 0 information *(2.5 pts)*
- Background and motivation (*5 pts*)
- What is technique? (*2.5 pts*)
- How does technique work? (*7.5 pts*)
- Unique contribution to science (2.*5 pts*)
- Application (*5 pts*)

Form and style (*20 pts*)
- Slide quality (*7.5 pts*)
- Verbal quality, eye-contact, body-language (*5 pts*)
- Timing (*7.5 pts*)

Deadlines *(2.5 pts)*

Rough timing point rubric:
- <2:40 = 7.5 pts – (1 pt/8 sec)
- 2:40 – 3:15 = 7.5 pts
- >3:15 = 7.5 pts – (1 pt/4 sec)

General tips:
1. You may need to do some additional research to prepare for your presentations. It may be helpful to present a figure from an earlier paper or an elementary book to help you describe aspects of how a technique works. You will not have time to go into great detail about the technique, but be prepared to briefly describe it in fundamental terms.
2. A good rule of thumb for presentations is to be prepared to answer questions at least "one layer deeper" than what you directly present. This may be difficult for you in this case, and will not always be possible, but keep the rule of thumb in mind.
3. The goal of any presentation (especially these) is not to impress the audience, including the instructor. The *goal is to present information and educate*. If your peers do not learn from your presentation, it was not successful – even if it contained lots of details or information. Finding a way to explain your material in the amount of time you have available is the key challenge.
4. It is best to use no cue cards (or at most very few) in an effort to maintain eye contact with the audience. Avoid using electronic devices (e.g. additional tablet) containing your notes. It is generally best to put bulleted text on your slides that will help remind you of what to say.
5. You will not be expected to be an expert in the area of your talk, but do your best.
6. Practice your talk before-hand.

Some helpful repositories of information for giving a good presentation:
Peter J. Feibelman, A PhD is Not Enough, Chapter 4: Giving Talks (.pdf scan on Blackboard)
David M. Schultz, Eloquent Science, Chapters 24-26 (.pdf scan on Blackboard)

http://pubs.acs.org/cen/employment/87/8717employment.html
http://pubs.acs.org/subscribe/archive/tcaw/10/i11/html/11work.html
http://www.ics.uci.edu/~kay/courses/139w/presentationreview.html
http://www.cgd.ucar.edu/cms/agu/scientific_talk.html
http://www.wfu.edu/~fetrowjs/Courses/JournalClub/HowToFall2007.pdf

Fall Quarter 2013

CHEM 3220 - Advanced Analytical Chem.
Dr. Huffman

Group Presentation Assignment

You will be divided into groups of two and assigned a topic to research thoroughly and present (20 min.) to the class as a team. Assignments will be made within the first week of class so that you will have the majority of the quarter to prepare. This assignment will help you practice your literature searching and presentation skills as well as introduce you and the class to new areas of analytical chemistry.

Presentation Overview:
The presentation should be approximately 20 minutes in length, with an additional 10 minutes reserved for audience questions. The purpose is to present an analytical chemical technique that is beyond the scope of the rest of the lecture plan and that will hopefully be interesting to you. The workload and presentation time should be divided approximately equally between both group members. The presentation should utilize a Powerpoint-style presentation (and white-board if helpful and appropriate) that covers the topic assigned. Care should be given to present a meaningful background to motivate the purpose of the technique and enough technical detail for students to learn both how the technique works and how/why it would be chosen and applied. Prepare your presentation to be appropriate to an upper division/graduate level chemistry audience, meaning that they probably have a roughly similar background to you with respect to this topic. If you knew nothing about the topic you were assigned, they probably won't either. However, also provide enough scientific detail to challenge people some too.

Audience members will be expected to listen attentively and ask questions at the end of each presentation. There will not be time for everyone to ask questions after each talk, but a general 'participation' grade will be assigned to each student at the end of the quarter. Peer grades assigned by the class will constitute 10% of the total. Additionally, there will be questions on the final exam from the group presentations.

Pertinent Dates:
Sept. 11 (Wed.) – Turn in topic request
Sept. 13 (Fri.) – Groups assigned by Dr. Huffman
Presentations – Individual presentation dates to be assigned

A. Meeting #1 – minimum 3 weeks* before presentation
B. Meeting #2 – minimum 2 weeks* before presentation
C. Email 150-word abstract to class – at least before 1 class period prior to presentation
D. Email presentation to Dr. Huffman (Powerpoint or Acrobat) – 9 am on presentation day

* Note Dr. Huffman's travel schedule on the syllabus. You will be responsible for scheduling meetings far enough ahead of time to avoid conflict.

Meeting #1 is intended to help make sure the general range of your research focus will be appropriate (e.g. this is not meant to be a graduate thesis, but also not a short 'book report'). Topics below are listed broadly to allow you to focus on areas of your particular interest. Before meeting #1 both group members should begin their literature research and have thought together about their interests and presentation focus. You should thus come prepared with your general ideas of what you want to present. Dr. Huffman will help verify that the scope is appropriate so that you don't waste time digging too broadly or deeply.

Meeting #2 is intended to help you start focusing your presentation appropriately. It is another chance to briefly discuss with Dr. Huffman as a group to focus your research and preparation. For this meeting you should bring a rough outline of your presentation to show Dr. Huffman.

Topics areas:

1. Paper-based microfluidic sensors
2. Surface enhanced Raman spectroscopy
3. Two-dimensional gas chromatography
4. Smartphone detectors in analytical chemistry
5. STXM &NEXAFS (scanning transm. x-ray microscopy & near edge x-ray absorp. fine structure)
6. Emerging immunosensors for protein detection
7. Hydrogen exchange mass spectrometry
8. Ambient ionization techniques for MS
9. Single aerosol mass spectrometry

On Sept. 11 (Wed.) turn in topic request sheet.

Presentation grade break-down/rubric (*preliminary*):

Presentation score will account for 15% of the final course grade
One grade will be assigned to the group as a unit, with the exception of the peer and partner portions of the grade (10% of overall presentation grade, see below).

Preparation (*10 pts*)
- Meeting #1 (*5 pts*)
- Meeting #2 (*5 pts*)

Presentation content (*40 pts*)
- Appropriate scope (*5 pts*)
- Background and motivation (*5 pts*)
- How does technique work? (*10 pts*)
- Unique contribution to science (*5 pts*)
- Application (*5 pts*)
- Summary/Conclusions (*3 pts*)
- Ability to answer questions (*7 pts*)

Presentation form and style (*30 pts*)
- Slide quality (*10 pts*)
- Verbal quality, eye-contact, body-language (*5 pts*)
- Team balance (*5 pts*)
- Timing (*5 pts*)

Miscellaneous (*20 pts*)
- Abstract (*5 pts*)
- Deadlines (*5 pts*)
- Peer and partner grade (*10 pts*)

Fall Quarter 2013

CHEM 3220 - Advanced Analytical Chem.
Dr. Huffman

"13 Ideas" Assignment

"Beware of a man with a single idea." - Anonymous

Among the most important skills of a scientist is the generation of novel ideas. The ability to successfully generate creative thoughts and put them into practice is what fundamentally separates an independent scientist from a technician [though let me explicitly point out that both are fine careers] and often influences career paths at least as much as scientific knowledge. However, students of the sciences are not often taught to practice creativity, especially as it relates to the scientific disciplines of their interest.

James Christensen, professor of chemical engineering, stated that "the best way to enhance creativity is to have more ideas. If ten ideas give one creative idea, then twenty ideas will give two creative ideas. What we need are more ideas, whether bad or good, in order to find the good ones." Accordingly, this assignment is designed to help you practice generating scientific ideas, a skill that you will need for the rest of your career in science.

Assignment overview:

- You will be required to turn in 13 unique ideas, generated from whatever scientific problems you desire to tackle. The guidelines are simple: ideas are to be (1) self-generated and (2) concisely described.
- The ideas themselves are not so important. It doesn't matter if the ideas are practical, although some of your ideas might even be patentable or ground-breaking. The point is that in generating the ideas you experience a creative process, conceptualize and describe new ways to solve problems. For some students, this may be your first taste of the creative freedom inherent in applying intuitive thought to problem solving.

Assignment details:

- A total of 13 unique ideas must be turned in by Wednesday, Nov. 15 (2nd to last day of class).
- At least the first 5 ideas must be turned in by Monday, Oct. 14 (course half-way mark).
- Each idea should be numbered, titled, and described in a short paragraph of text (100-200 words).
- Ideas document:
    - Ideas should be emailed combined as a single document and can be sent at any time (with any number of ideas).
    - Each idea (along with number and title) should be on a separate page (use page break).
    - Add ideas as new pages as they are generated and send updated document periodically.
- The idea text should explain: (1) the key idea, (2) any available specifics, and (3) idea novelty (e.g. how is this idea unique to the world).
    - It may be helpful to employ the "Problem = xx; Solution = yy" strategy, but not required.
- Dr. Huffman will not evaluate or judge the ideas other than to verify that each idea is (a) sufficiently independent from ideas of other students, (b) sufficiently novel, and (c) reasonably within the bounds of physical laws.
- You do not need to do extensive research to evaluate whether similar ideas have been proposed by someone else, but ideas that could "obviously" be labeled unoriginal will not be accepted.
- You may discuss these ideas with anyone you wish, as long as each idea submitted is unique.
- We can discuss individually if you would like assistance at any point.
- Grades will be assigned based solely on the fraction of ideas submitted and accepted.
- Submitting ideas well before the deadlines is suggested in case any ideas are not accepted.
- The assignment will account for 10% of the final course grade.

References/Inspiration:

The inspiration for this assignment and some of the text/wording above comes directly from an article written by a fascinating colleague of mine: Dr. David Sands at Montana State University.

- Sands, D.: Rediscovering idea generation in a scientific discipline, Plant Disease, 76, 1079, 1992.

Last year's students responded favorably to this assignment in anonymous feedback after the course.

A few other sources of ideas-generating inspiration from the web have been linked here:
http://www.blueglassarchive.com/blog/how-to-generate-ideas/
http://www.powerhomebiz.com/leadership-management/leadership/generate-brilliant-ideas.htm
http://www.wakeupcloud.com/generate-ideas/

A few quotes on ideas taken from:
http://www.innovationexcellence.com/blog/2010/11/15/50-great-quotes-on-ideas/

1. *"If at first, the idea is not absurd, then there is no hope for it."* – Albert Einstein
2. *"If you do not express your own original ideas, if you do not listen to your own being, you will have betrayed yourself."* – Rollo May
3. *"Ideas are like rabbits. You get a couple and learn how to handle them, and pretty soon you have a dozen."* – John Steinbeck
4. *"The way to get good ideas is to get lots of ideas and throw the bad ones away."* – Linus Pauling
5. *"If I have a thousand ideas and only one turns out to be good, I am satisfied."* – Alfred Noble
6. *"No idea is so outlandish that it should not be considered."* – Winston Churchill
7. *"A new idea is delicate. It can be killed by a sneer or a yawn; it can be stabbed to death by a quip and worried to death by a frown on the right man's brow."* - Ovid