CHEM 313 Environmental Chemistry Laboratory - Syllabus, Fall 2013

General Information:

The laboratory course meets every Tuesday from 10:00am to 1:50pm in FH 313. In total ten individual experiments are scheduled with one discussion session on October 15, 2013. We will use the discussion to talk about the experiments already done and the ones to be carried out during the remainder of the semester.

The students work on the experiments in groups of 3, but each student will submit a written lab report one week after completion of each lab. The dates and format of the lab reports are outlined below.

An introductory meeting is scheduled for August 27, 2013 to discuss the course procedure, check the lockers and obtain general safety instructions. Course materials will be provided either as hard copies, or as electronic copy via Sakai.

Objectives:

The course will help understanding of basic environmental principles and important environmental issues via selected experiments. Through these experiments laboratory and critical thinking skills will be acquired applicable to any environmental field. Team working skills will be fostered as well as writing laboratory reports.

Experiment	Experimental work	Lab Report due date
1) Iron in natural waters	September 3, 2013	September 10, 2013
2) Chloride in natural waters	September 10, 2013	September 17, 2013
3) pH, buffer, conductivity in natural waters	September 17, 2013	September 24, 2013
4) PAH's in environmental samples	September 24, 2013	October 1, 2013
5) Photolysis of iron	October 1, 2013	October 15, 2013
Break	October 8, 2013	
Discussion	October 15, 2013	
6) Air oxidation of metal ions	October 22, 2013	October 29, 2013
7) Halogenated hydrocarbons and the ozone depletion	October 29, 2013	November 5, 2013
8) Acid Mine Drainage	November 5, 2013	November 12, 2013
9) Removal of Nitric oxide by complex formation	November 12, 2013	November 19, 2013
10) Ion Chromatography for environmental samples	November 19, 2013 November 26, 2013	December 3, 2013
Check out and final discussion	December 3 ,2013	

Laboratory Report Format

The lab report should include page numbers and be proofread before submission. It is also recommended to print reports double sided to save paper.

Each lab report should consist of:

a) Title page

Should contain: title of report, name of student, name(s) of the other group members, name of the course, date of experiment, date of report.

b) Introduction

Should include: brief description of the background of the experiment. For example, what are the reasons for the experiment performed, what species or property is measured and why, how does the instrument used work and what does it measure etc.

c) Experimental

Should include:

*Reagents and glassware used,

*Apparatus used (manufacturer, model etc.)

*Instrumental settings

*Description of sample preparation procedure, standardization procedure

All of this should be formulated in such way that somebody else will be able to perform the lab after reading this report.

d) Results

Should include:

*Raw Data (Organized in tables that are properly labeled. Should be clearly readable and understandable)

*Sample calculations (one example calculation for each calculation procedure should be shown, including proper units and significant figures and explained). The sample calculation needs to be labeled (trial # used for example calculation). Calculations are to be typed, not handwritten!

*Data calculated (also organized in tables and properly labeled)

*Graphs and Figures (all graphs should be stand-alone and must be numbered, labeled properly and titled, provide a brief description for each graph/figure, linear regression should be used to obtain straight lines and the parameter must be included, this part should also include all spectra and/or chromatograms labeled and numbered properly). Handwritten graphs will not be accepted; use Excel or another graphing program to generate calibration curves, etc.

e) Discussion

The discussion should refer to the range of data, whether the data are useful and make sense, what are the implications of the data, what kind of errors could be present and what is the

meaning of the data with respect to the sample analyzed.

f) Conclusions

This should conclude the experiment with respect to importance of method, selectivity of instrumentation (maybe another method would be more appropriate?)

g) References

All references used should be cited in accordance to the ACS published journal "Analytical Chemistry".

The report style should be like in a peer reviewed paper with all pertinent information present. All sections of the report are to be clearly labeled. Despite data sharing as working in a group on the experiments, each student has to turn in his/her own report with own calculations, discussion, conclusion etc.

Grading Scale for Lab Reports:

Each lab report is worthy 100 points distributed in the following:

Title page	05 points
Introduction	10 points
Experimental	20 points
Results	40 points
Discussion	15 points
Conclusions	05 points
Overall appearance	05 points

Points will be taken off when parts are missing from the listed items a) to g).

Detailed list of experiments:

1) Determination of iron in natural waters

Chemicals and Equipment
Spectrophotometer and Cuvettes
0.01M KSCN
HCl
conc. H_2SO_4
$FeSO_4*(NH_4)SO_4*6H_2O$ ferrous ammonium sulfate hexahydrate
Na-Citrate buffer (pH=4.5)
10% hydroxylamine hydrochloride
0.3% 1,10-phenanthroline

pH paper or pH meter
500mL, 100mL(4x) volumetric flask
Balance
Pipets 0.5 and 1.0mL
Beakers to store the solutions

2) Determination of chloride ions in natural waters

Chemicals and Equipment
AgNO3
250mL volumetric flask
10, 25, 50mL volumetric pipets
250mL Erlenmeyer
pH paper or pH meter
K2CrO4
buret
HNO3
NaOH
CaCO3
Conductivity electrodes
Stirrer
Ion Selective Electrode (Chloride Electrode)
Waste container

3) Determination of pH, buffer capacity and conductivity of natural waters

Chemicals and Equipment
pH electrode and potentiometer
Buffer solutions of pH 7 and 10
Beakers to store the solutions
Buret
Ring stand, buret clamp
stirrer
HCl (0.01M and 0.1M)

4) Determination of PAH's in environmental samples

Chemicals and Equipment
Sample
pipetts plus pipet tips for standard and sample preparation (10-200µL, 100-1000µL)
anthracene and naphthalene solid
cyclohexane
Analytical balance

Weigh boats/paper
Scupula
18 MΩ water
Quartz glass cuvettes
10mL volumetric flasks
Lab notebook
Calculator
Spectrophotometer

5) Photolysis of Fe(III) EDTA

Chemicals and Equipment
$FeCl_3*6H_2O$
$K_3[Fe(CN)_6]$
Na_2EDTA
NaOH
10mL volumetric flasks
Analytical balance
Weigh boats/paper
5-cm long test tube
Aluminum foil
Sunlight or overhead projector

6) Air Oxidation of metal ions

Chemicals and Equipment
1pH meter
1 aquarium pump
Tubing
graduated pipets, serological and transfer pipet
test tubes 10 cm long
rubber stoppers
beakers
filtration membranes 0.45micron and supports
microburet
lab stand
10mL syringes
0.05M FeSO4x7H2O
1M KSCN
2M and conc. HCl
0.01M K4[Fe(CN)6]
2M NH4OH
Water

5M NaOH
3M, 0.1M and 0.01M H_2SO_4
0.05M$KMnO_4$

7) Halogenated Hydrocarbons and the Ozone Layer Depletion

Chemicals and Equipment
2kg and black plastic bags
10mL syringes
1mL volumetric pipet
2mL microburets
Three finger clamp and stand
Magnetic bar and stirrer
10mL beakers
Long wave UV pencil lamp
Stop watch
10mL Erlenmeyer flasks
Ozone generator
0.3 M KI
0.0005 M $Na_2S_2O_3 \times 5H_2O$
CH_2Cl_2
0.5% starch solution
Conc. H_2SO_4

8) Acid Mine Drainage

Chemicals and Equipment
pH meter
20mL beakers
Magnetic stirrer
Aquarium pump
Beral and 2mL graduated pipets
Spatula
N_2 gas
FeS (solid)
Water
Ferric sulfate

9) Removal of Nitric Oxide by Complex formation

Chemicals and Equipment
5mL vials
20 mL filter flasks
10mL syringes
1 and 2mL pipets, graduated
10 mL beakers
25 mL Erlenmeyer flasks

Plastic septa
Well plate
Plastic cap
Spectrophotometer and cells
Rubber tubing
Magnetic stirrer
Fe(II)EDTA
KNO2
1M H2SO4
1MKOH
FeSO4x7H2O
Na2H2EDTA
Na2S2O4
N2gas
Water

10) Analysis of inorganic ions in environmental samples by ion chromatography

Chemicals and Equipment
Sample
Eluent (NaCO3, NaHCO3)
Sulfuric Acid
18mOhm water
Ion Chromatograph