

## CHEM 313 Environmental Chemistry Laboratory- Syllabus, Fall 2011

### General Information:

The laboratory course meets every Tuesday from 8:30am to 12:20pm in FH 313. In total seven individual experiments are scheduled with a discussion session the week following each experiment. During the discussion students will talk about their experience with the experiment, the significance of the experiment in the environmental context and exchange ideas for anything associated with the topic. The course will also have an ongoing discussion on Blackboard.

Discussions are intended to be interactive with mostly students taking the lead and only minor guidance from the instructor.

The students work on the experiments in groups of 2-3 depending on class size. Each student will submit a written lab report following completion of each lab. The format is outlined following the course timeline.

An introductory meeting is scheduled for August 30, 2011 to discuss the course procedure, check the lockers and obtain general safety instructions.

Experiment	Experimental work	Discussion	Lab Report due date
1) pH, buffer, conductivity in natural waters	September 6, 2011	September 13, 2011	September 20, 2011
2) Chloride in natural waters	September 20, 2011	September 27, 2011	October 4, 2011
3) Iron in natural waters	October 4, 2011	September 27, 2011	October 18, 2011
4) PAH's in environmental samples	October 18, 2011	October 25, 2011	November 1, 2011
5) Photolysis of iron	November 1, 2011	November 8, 2011	November 15, 2011
6) Ion Chromatography for environmental samples	November 15, 2011	November 22, 2011	November 29, 2011
7) Phytoremediation	November 29, 2011	December 6, 2011	December 13, 2011

### 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 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)

#### **2) Determination of chloride ions in natural waters**

##### *Chemicals and Equipment*

AgNO<sub>3</sub>  
250mL volumetric flask  
10, 25, 50mL volumetric pipets  
250mL Erlenmeyer  
pH paper or pH meter  
K<sub>2</sub>CrO<sub>4</sub>  
buret

HNO<sub>3</sub>  
NaOH  
CaCO<sub>3</sub>  
Conductivity electrodes  
Stirrer  
Ion Selective Electrode (Chloride Electrode)  
Waste container

### 3) Determination of iron in natural waters

#### *Chemicals and Equipment*

Spectrophotometer and Cuvettes  
0.01M KSCN  
HCl  
conc. H<sub>2</sub>SO<sub>4</sub>  
FeSO<sub>4</sub>\*(NH<sub>4</sub>)SO<sub>4</sub>\*6H<sub>2</sub>O 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

### 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<sub>3</sub>\*6H<sub>2</sub>O

K<sub>3</sub>[Fe(CN)<sub>6</sub>]

Na<sub>2</sub>EDTA

NaOH

10mL volumetric flasks

Analytical balance

Weigh boats/paper

5-cm long test tube

Aluminum foil

Sunlight or overhead projector

**6) Analysis of inorganic ions in environmental samples by ion chromatography**

*Chemicals and Equipment*

Sample

Eluent (NaCO<sub>3</sub>, NaHCO<sub>3</sub>)

Sulfuric Acid

18mOhm water

Ion Chromatograph

**7) Phytoremediation of copper with mustard plants**

*Chemicals and Equipment*

4 Plant pots

Topsoil

Mustard seeds

Water

EDTA

CuNO<sub>3</sub>

ZnNO<sub>3</sub>