Fall 2018 Chemistry 1B

Instructor: Dr. Kirk Kawagoe (dr.k)
Office: Soc 38
Email: via Canvas

Class schedule

§88195 Lecture – T/R 12:30 – 1:45 PM. Room 76
Lab – T/R 2:00 – 4:50 PM. Room 82
Office Hours W/Th 10-11:00 AM, F 12-2:00 PM

Required Materials

- Chemistry: A Molecular Approach, Nivaldo J. Tro
  - *Any version*, **but** you must buy the online homework

On-line Homework (bundled with book)

- www.masteringchemistry.com
  Course ID: MCKAWAGOE37976
- Scantron form 882E (letter answers)
- Lab Notebook: Provided
- Calculator: TI-36X Pro (non-graphing)
- Approved Safety Goggles and Lab Coat
- Lecture notes and experiments are found on the course **Canvas** page.

Attendance Policies

If you are absent four (4) times in the first 9 weeks you will be dropped from the course. In order to be counted as present you must arrive on time, participate in the experiment or activity, and, unless otherwise instructed, stay the entire lab period. In other words, if you arrive late, leave early, or do not participate in lab activities, you may be counted absent and given a zero on your lab exercise. Note: Showing up late for lab is a safety risk for you and others, as specific safety concerns are generally addressed at the beginning of lab. Contact me if you miss class. If you are absent, you must still meet the assignment due dates. You may also be counted absent if you leave class early. I will accept most reasonable excuses for being absent (circumstances beyond your control).

Disabled Students Programs Services

if you have a verified need for an academic accommodation or materials in alternate media (i.e., Braille, large print, electronic text, etc.) per the Americans with Disabilities Act (ADA) or Section 504 of the Rehabilitation Act, please contact me as soon as possible.

Homework

Homework grade policies and due dates are found on MasteringChemistry.com.

Do your work in a notebook and show me during lab to receive credit. See the prerequisite math note for what to include for calculation problems.

Final Exams

Your Final Exam is the American Chemical Society (ACS) First Term Exam. A mid-C grade is the 50th percentile on the exam. The exam is timed (approximately 2 hours, 70 questions) and **the ACS does not allow students to use graphing calculators during the exam.**
The final exam 12/11/18 (Tuesday) 12:00 – 1:50 PM

Grading and Exams

- The **grading scale** *starts* as:
  A = 100% - 90%; B = 89% - 80%; C = 79% - 70%; D = 69% - 60%; F = 59% - 0%
  Exams, labs, and homework are not curved, but the overall grades in the class may be curved at the end of the semester.
- Exam dates are found in the accompanying schedule, I will try and stick with this exam schedule, but may alter the material covered or dates if necessary. There are no makeup exams. If you miss an exam, you will receive a zero. At the end of the semester, I will replace your lowest exam score with your final exam score.
- No one who fails the lab portion of this course (a letter grade of D or lower) will receive a grade higher than a D.

Class Tests	45 %
Homework (online)	10 %
Final exam	20 %
Laboratory & Worksheets	25 %
Total	100 %

Academic Dishonesty

Cheating is the act or attempted act of taking an examination or performing an assigned, evaluated task in a fraudulent or deceptive manner. Cheating may include, but is not limited to, copying from another's work, supplying one's work to another, giving or receiving copies of examinations without an instructor's permission, using or displaying notes or devices inappropriate to the conditions of an examination, allowing someone other than the officially enrolled student to represent the student, or failing to disclose research results completely.

You are encouraged to work together on labs. However, ***your individual work must be evident***. **Do not copy work or allow others to copy from your work**. Instances of confirmed cheating will generally result in failure and be referred to the Dean for further action.

Electronic devices such as cell phones, tablets, etc. are not allowed during exams and must be put away in a backpack or purse; confirmed use of these devices constitutes cheating.

In general, students will get either an F for the course or minus the number of points on the assignment for cheating or plagiarism. The colleges academic dishonesty policy is found in your College Catalog (Pages 49-50, RC 2017-18 Catalog).

COURSE DESCRIPTION

***5 units**. 3 lecture hours, 6 lab hours. (A, CSU-GE, UC, I)*

Course Description: This course completes the yearlong general chemistry sequence (1A-1B) and covers the principles of physical and inorganic chemistry with an emphasis on quantitative, mathematical problem solving. Topics covered include acid-base theory, chemical kinetics, equilibrium (acid-base, hydrolysis, and solubility), chemical thermodynamics, electrochemistry, selected topics in nuclear chemistry, coordination chemistry, and/or chemistry of selected groups. Students will analyze inorganic compounds qualitatively and quantitatively. (A, CSU-GE, UC, I) (C-ID CHEM 120S: CHEM 1A & CHEM 1B)

Prerequisite: Chemistry 1A and **Mathematics 103 or equivalent*.**

Advisories: English 1A.

Course Objectives for CHEM 1B:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

A. use chemical kinetic mathematical operations to determine order and rates of a reaction and understand the effects of temperature;
B. apply Le Châtelier's Principle to systems displaced from equilibrium, mathematically solve for the equilibrium constant, and describe limitations involving the equilibrium constant
C. demonstrate the ability to classify acids and bases and then determine equilibrium constant and pH of acids, bases, and buffers;
D. solve problems involving the common-ion effect in acid-base and solubility equilibria;
E. evaluate neutralization reactions and titration curves;
F. recognize fractional precipitations and equilibria involving complex ions;
G. recognize the concept of qualitative cation analysis and be able to perform related laboratory experiments;
H. solve simple problems involving chemical thermodynamic problems (work, heat, internal energy, enthalpy, entropy, and free energy);
I. examine the Second Law of Thermodynamics and apply to the spontaneity of a reaction and the complexity of natural systems;
J. discuss concepts of an electrochemical cell and mathematically solve for a standard cell potential, change in standard free energy, and equilibrium constants;
K. recognize physical and chemical properties of element groups (e.g. alkali metals; alkaline earth metals, transition elements, group 13 metals, group 14 metals, nonmetals including halogens, and noble gases);
L. identify and describe the bonding of complex ions and coordination compounds;
M. discuss general concepts of nuclear chemistry (e.g. stability, decay, fission, fusion, radioactivity, and nuclear reactions);
N. perform laboratory procedures and techniques used in semimicro qualitative and quantitative analysis of simple inorganic ions, and the apparatus and measurements used in simple calorimetry and electrochemistry experiments
O. demonstrate skills in the laboratory in the use of the analytical balance, titration, spectroscopy, pH meter, glassware, melting point apparatus, safety precautions and general laboratory procedures

STUDENT LEARNING OUTCOMES

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

A. Solve and explain chemical kinetics and mechanisms problems
B. Solve and explain chemical equilibrium questions including but not limited to acid/base and pH concepts
C. Solve and explain problems on thermodynamic concepts
D. Solve and explain problems on electrochemical concepts
E. Explain the fundamental concepts of nuclear chemistry
F. Demonstrate general chemistry skills in the laboratory including qualitative analysis

*** Prerequisite math note**: My experience is that students who have completed more math will do better in the course. This is not because the course requires more math, but the problems in chemistry require the ability to read and apply math to word problems. Make sure you work on your problem-solving skills throughout the semester. Follow the textbook method given in the solutions to the calculation examples throughout the text. In brief:

1. Sort the information
   a. Given
   b. Find
2. Strategize
   a. Conceptual Plan – how are the given and "find" related
   b. Relationships – What relationships do you need?
      i. Equations
      ii. Conversion factors
3. Solve
   a. Set up a solution based on the plan
   b. Check your units
   c. Calculate the answer
   d. Check your significant figures and round
4. Check
   a. Does the answer make sense?

Advice on Reading

1) Read the **summary** of the chapter first.
   a) You may not know what you are reading, but this will give you a framework to remember things.
2) **Do all the examples** before reading each section. Read the answers given in the text. They help explain how each problem is done.
   a) If it's not perfectly clear, read the section carefully.
   b) If it is clear, then move to the next section (we assume you learned enough from lecture or previous classes)
3) Take notes in the margins as you read. Write short summary statements or questions to ask in class.
4) Take the end of chapter "Self-Assessment Quiz". These will also be posted on-line.

LAB (Covered in the first lab period)

- **You are responsible for knowing the lab safety rules**, therefore carefully read the lab safety contract. <u>You will need to **sign** the lab safety contract before being allowed to perform any experiments.</u>
- **Experiments: Experiments are downloaded from Canvas.** You are required to **complete prelab assignments before starting any experiment.** If you do not have the prelab work completed, you forfeit the points for that assignment. (see prelab instructions on below).
- **Worksheets: You must bring your own copies of worksheets and study guides.**

Prelab Assignments

There are **two different prelab assignments**. Both need to be completed **before coming to *class*** to do an experiment.

- Prelab Worksheets – These are found ***in*** the lab instructions you download from Canvas. Most of the questions can be answered by reading the experiment or the introduction to the experiment.
- Notebook – You need to write out the following in your notebook ***before you come to class. Use a pen!***
  - Purpose
  - Materials
  - Hazards
  - Procedure (For Chem 1A, you are allowed to bring a copy of the procedure at the beginning of the semester, but you must work from the procedure in your notebook. If important information is missing, you can refer to and supplement your prelab notes).
  - You should also leave space in your notebook for recording data. We will discuss this more in class.

  If the notebook work is not done before class, you will not be allowed to do your experiment for the day. You will receive a zero for that day.

- If we are doing a worksheet in class, **you will have to bring a copy of the worksheet**. I will allow you to do your work on separate paper, but you'll have to copy it to a worksheet before turning it in (i.e. you get to do it twice).

Syllabus quiz questions and answers. Note the quiz will be multiple choice. (End of first week). 5 pts.

1) Which of the following are required course materials?
   a) Text book, lab notebook, non-graphing calculator, goggles and a lab coat.
2) Which of the following statements are true?
   a) You have to pass lab to pass the class.
   b) You need a score of 70% or greater pass the class.
   c) Total lab points are worth about 2 exams.
   d) Total homework points are worth about the same amount as an exam.
3) If I am caught cheating, I should expect:
   a) to receive minus the possible score of the assignment or a failing grade for the course.
4) Which are you required to tell me contact me about?
   a) ADA accommodations and absences
5) For this course, how many absences are considered excessive by the school?
   a) Four
6) In order to receive points for homework I have to:
   a) Complete them before the due date and show your work (notebook is acceptable)
7) If I miss an exam:
   a) I get a zero, but my lowest score will be replaced by my final exam score.
8) Which of the following are part of the "prelab"?
   a) Prelab worksheet and lab notebook work.
9) What is done in the notebook before class starts?
   a) Purpose, Materials, Hazards, Procedure, and a space to record data.
10) If I don't finish the prelab assignments on time:
   a) I will get a zero
11) What kind of writing tool can I use in my lab notebook?
   a) A non-erasing pen.

What you need to know for the **memorization quiz** (end of second week). 20 questions, 8 minutes. 10 pts.

1) Names and symbols for the first 36 elements and silver, cadmium, tin, tellurium, iodine, xenon, barium, iridium, platinum, gold mercury, lead, bismuth, radon, and uranium.
2) Names, formulas, and charges of the common polyatomic ions. Look these up in the book or online.
   - Carbonate, nitrate, phosphate, sulfate, chlorate, arsenate, selenate, bromate, oxalate, hydroxide, acetate (CH_3COO^- or $C_2H_3O_2^-$), permanganate, and ammonium ions.

Here are some equations that are used to analyze data. Not all apply to every report.

Average value: $average, \bar{x} = \frac{\sum x}{n}$	Slope, intercept, correlation coefficient: y = mx + b, r (correlation) are calculated using a spreadsheet or calculator
Comparison to known values: $\% = \frac{your\ value - theoretical\ value}{theoretical\ value} \times 100\%$	Rejection of outliers: $Q_{exp} = \frac{Gap}{Range}$; $Q_{exp} < Q_{crit}$, the data point is kept
Precision of results, standard deviation: $s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$	Rejection of outliers: $G_{sus} = \frac{\lvert x_{suspect} - \bar{x} \rvert}{s}$, $G_{sus} > G_{crit}$, the data point is rejected
Percent relative standard deviation (RSD): $\%RSD = \frac{s_x}{\bar{x}} \times 100\%$	

Critical Values for G at 95% confidence

# of values	4	5	6	7	8	9	10
Critical Values	1.463	1.672	1.822	1.938	2.032	2.110	2.176

* These are the "one-sided" critical values, as recommended in ASTM method E178-02.

(see example on the next page)

G-test example

Data

You carry out the same experiment four times. For each experiment, you obtain a final mass of sample. These are the masses recorded.

1.675 g, 1.633 g, 1.669 g, 1.683 g, 1.672 g

Here's the question. The value 1.633 g seems like it might be a little low, but how do you know if it can be statistically removed?

Calculations

Here are the steps involved in answering the question:

1. Calculate the average and standard deviation.
2. Identify the potential outlier
3. Calculate the value G_{sus}
4. Compare G_{sus} to G_{crit}
5. If $G_{sus} > G_{crit}$ it means that the suspected value can be eliminated based on statistical grounds. Recalculate the average and standard deviation without the suspect data. Otherwise, you keep all the data.

1. Calculate the average and standard deviation.

   There are 5 data points (N = 5)
   Average = 1.6664 g
   Standard Deviation = 0.0193856 g (if you need help calculating this, let me know)

2. Identify the potential outlier
   There are many ways to calculate the potential outlier, but it is always either the highest or lowest value. In this case the value 1.633 g is furthest from the average.

3. Calculate the value G_{sus}

$$G_{sus} = \frac{\left| x_{suspect} - \overline{x} \right|}{s} = \frac{\left| 1.633 - 1.6664 \right|}{0.0193856} = 1.723$$

4. Find G_{crit}
   Since N = 5, G_{crit} = 1.672.

5. Compare G_{sus} to G_{crit}. If $G_{sus} > G_{crit}$ it means that the suspected value can be eliminated based on statistical grounds. Otherwise, you keep all the data.
   Because 1.723 > 1.672, we "reject" the value 1.633 g and recalculate the average and standard deviation without the suspect value.

   The new average is 1.675 g, s = 0.0060 g.