Harry S Truman College

One of the City Colleges of Chicago

Our Mission dedicates us to deliver high-quality, innovative, affordable, and accessible educational opportunities and services that prepare students for a rapidly changing and diverse global economy.

CHEMISTRY 203 PQR, Spring 2012

Welcome!

Instructor: Dr. Zoran Miodragovic **E-mail**: zmiodragovic1@ccc.edu
Office: 3624 **Phone**: 773-907-4694

Office hours: Mon 5:00 am – 5:45 pm Rm 3624

Class hours: Mon / Wed 6:00 am - 9:40 pm Rm 3162 - Studio Classroom

Length of the Course: 16 weeks

Credit hours: 5 Contact hours: 8 (4 lecture hours, 4 lab hours)

Website: **Blackboard (http://ccc.blackboard.com)**

PLEASE CHECK BLACKBOARD REGULARLY FOR NEW ANNOUNCEMENTS, HOMEWORK ASSIGNMENTS, SCHEDULE UPDATES, POINTS, ETC!

Course Catalog Description

General Chemistry II

Topics include chemical equilibrium, acid-base equilibria, solubility equilibria, kinetics, thermodynamics, electrochemistry, coordination compounds, nuclear chemistry, and descriptive topics in organic chemistry. Writing assignments, as appropriate to the discipline, are part of the course.

Prerequisite: Grade of C or better in Chemistry 201 or consent of Department Chairperson.

Required material

- **Recommended Textbook: *Chemistry: The Science in Context, 3th Ed.***
  by Thomas R. Gilbert, Rein V. Kirss, Natalie Foster, and Geoffrey Davies
  W.W. Norton & Company, New York · London © 2012, 2009, 2004
  ISBN: 978-0-393-93431-1

- **Labs:** There is no laboratory textbook to purchase for this class but you will need to print laboratory assignments from the blackboard.

- **Laboratory Notebook**: You must have a notebook with bound pages (spiral notebooks may not be used) in order to write results and observations during the experiments.

- **Calculator:** A scientific calculator with exponential notation and logarithms is required for exams, quizzes, lab reports, and homework. Using a cell phone or computer instead of an appropriate scientific calculator is not allowed.

Student Learning Outcomes

At the completion of this course, the successful student will be able to:

- Recognize the different intermolecular forces and their role in phase changes.
- Solve kinetic and equilibrium problems.
- Compare and contrast the chemical behavior and reactions of common substances.
- Categorize standard functions of enthalpy, entropy, and free energy and their applications to different systems including electrochemistry.
- Recognize transition metal coordination compounds.
- Classify organic compounds into main classes according to functional groups they contain.
- Collect quantitative data and organize it into meaningful charts and graphs.
- Discuss industrial processes for manufacture of major inorganic chemicals.
- Analyze experimental data and draw appropriate conclusions from data and chemistry theories.
- Write a formal laboratory report.

Course Objectives for Chemstiry 203

At the completion of this course, the successful student will be able to do the following:

Redox Reactions

1. (R) Determine the oxidation state of each atom in a compound.
2. Balance Redox reactions in acidic and basic solutions.

Chemical Kinetics

3. Define the two types of rate laws: differential and integrated.
4. Distinguish between a first-order reaction and a second-order reaction.
5. Give an example of a reaction mechanism.
6. Discuss the effect of a catalyst on a chemical reaction.
7. State the Arrhenius equation and use it to solve problems.
8. Discuss the collision model of chemical reactions and how various factors such as temperature can affect reaction rate.

Chemical Equilibrium

9. Define chemical equilibrium.
10. Calculate the equilibrium constant from concentration data.
11. Define and discuss Le Châtelier's Principle
12. Solve a variety of chemical equilibrium problems

Acids and Bases

13. State the definition of an Arrhenius acid, a Brønsted-Lowrey acid and a Lewis acid.

14. Solve problems using ionization constants, concentrations and pH or pOH for weak acids and weak bases.
15. Plot titration curves and label the midpoint, the buffer region and the equivalence point. Identify major species present for any point along the curve.
16. Give the conjugate base for any acid or the conjugate acid for any base.
17. Use the Ka to determine the strength of an acid or base.
18. Calculate pH and pOH.
19. Calculate percent dissociation of a weak acid.
20. Give examples of household products that are acidic or basic.
21. Define polyprotic acid.
22. Write chemical reactions for acids and bases.
23. Describe the preparation of a buffer.
24. Describe the use of acid-base indicators.
25. Discuss the common ion effect as it relates to acids and bases in solution.

Solubility

26. Use the solubility product to solve for ion concentrations in solution.
27. Determine ion concentrations when a common ion is present.
28. Describe a classic scheme for qualitative analysis of metal ions.
29. Define complex ion
30. Discuss the effect of complex ions on solubility.

Free Energy, Entropy and Thermodynamics

31. Apply Hess' Law to Thermodynamic Problems.
32. Apply Gibbs-Helmholtz equation to the solution of problems.
33. Discuss spontaneous chemical reactions.
34. Discuss entropy and the Second Law of Thermodynamics
35. Discuss the effect of temperature on spontaneity of a chemical reaction
36. Define free energy.
37. Relate free energy and equilibrium.

Electrochemistry

38. Draw a galvanic cell.
39. Identify the anode and cathode of a galvanic cell.
40. Write half reactions for galvanic cells.
41. Calculate EMF for galvanic cells.
42. Describe the structure and functioning of a lead acid battery.
43. Discuss the electrolysis of water.
44. Use the Nernst equation.

Coordination Compounds

45. Apply Lewis theory of acids and bases to complex ions.
46. Name relatively simple coordination compounds.
47. Give examples of mono- and polydentate ligands
48. Discuss isomerism in coordination compounds

49. Predict geometry and hybridization of coordination compounds.
50. Discuss complex-ion equilibria in solutions.
51. Apply crystal field theory to explain color and magnetic properties of coordination compounds.

Nuclear Chemistry

52. Describe the structure of the nucleus.
53. Define alpha and beta particles and gamma radiation.
54. Use isotopic notation to write a nuclear reaction.
55. Discuss the kinetics of radioactive decay and the meaning of half-life.
56. Discuss the detection of radiation.
57. Discuss radioactive dating.
58. Give examples of medical applications of nuclear chemistry.
59. Differentiate between nuclear fussion and nuclear fission.
60. Discuss the health effects of radiation.
61. Define rems and rads.

Organic Chemistry

62. Recognize chief class of organic compounds and their most characteristic chemical reactions

General

63. Maintain a detailed laboratory notebook.
64. Write professional laboratory reports.
65. Discuss applications of these chemistry topics to the world at large.

General Education Goals Established by Truman College

- **GEG1:** The student exhibits social and ethical responsibility and is aware of her or his place in the global community.
- **GEG2:** The student performs effectively in the workplace and has the ability to work and make effective use of a wide variety of current technologies.
- **GEG3:** The student communicates effectively in both written and oral formats.
- **GEG4:** The student demonstrates the ability to think critically, abstractly, and logically.
- **GEG5:** The student gathers, interprets and analyzes data.

Physical Science and Engineering Departmental Learning Outcomes

Upon graduation with an Associate degree from Truman College a student should be able to:

- Organize, analyze and interpret information and use the scientific method to make inferences.
- Exhibit knowledge of scientific concepts through written and oral communication.
- Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technologies.
- Use the lexicon of science to explain abstract scientific concepts.
- Relate concepts learned in Physical Science and Engineering Department classes to real world situations.

Topical outline and tentative schedule

This schedule may be subject to change

Date	Topic	Related chapter in the textbook
W, 01/18	Course orientation. Lab safety. Review	
M, 01/23	*Quiz 1: Syllabus and Lab Safety* Descriptive Topic in Organic Chemistry: Reading assignment Ch. 13.1-13.4	13
W, 01/25	Descriptive Topic in Organic Chemistry /continuation/ Reading assignment Ch. 13.5-13.8	13
M, 01/30	*Quiz 2: Chapter 13* Thermodynamics: Reading assignment Ch. 14.1-14.3	14
W, 02/01	Thermodynamics /continuation/: Reading assignment Ch. 14.4-14.6	14
M, 02/06	*Quiz 3: Chapter 14* Chemical Kinetics Reading assignment Ch. 15.1, 15.2, and 15.3 until "Integrated Rate Laws: Second-order Reaction "	15
W, 02/08	Chemical Kinetics /(continuation/ Reading assignment Ch. 15.3 starting from "Integrated Rate Laws: Second-order Reaction", 15.4, and 15.5	15
M, 02/13	Chemical Kinetics /(continuation/ Reading assignment Ch. 15.6 ***LAB 1***: Chemical Kinetics: Reaction Rate and Activation Energy.	15
W, 02/15	*Quiz 4: Chapter 15* Chemical Equilibrium Reading assignment Ch. 16.1 – 16.5	16
M, 02/20	**No Classes - President's Day Holiday**	
W, 02/22	Review **Exam 1: Chapters 13, 14, and 15** Lab Report 1 is Due	
M, 02/27	Chemical Equilibrium /continuation/ Reading assignment Ch. 16.6 – 16.10 ***LAB 2***: Chemical Equilibrium – LeChatellier's Principle	16
W, 02/29	*Quiz 5: Chapter 16* ***LAB 3***: Determination of the Thermodynamic Parameters for the Solvation of Borax	
M, 03/05	Chemical Equilibrium in the Aqueous Phase Reading assignment Ch. 17.1-17.5 Lab Report 2 is Due	17
W, 03/07	Chemical Equilibrium in the Aqueous Phase Reading assignment Ch. 17.6-17.8 and 17.10 ***LAB 4****:* Properties of Buffers	17
M, 03/12	Lecture: Equilibrium in the Aqueous Phase /continuation/ Reading assignment Ch. 17.9 ***LAB 5****:* Spectrophotometric Determination of Equilibrium Constant	17

W, 03/14	*Quiz 6: Chapter 17* Coordination compounds: Reading assignment Ch. 18.1-18.6 Midterm grades are due	18
M, 03/19	Coordination compounds /continuation/: Reading assignment Ch. 18.7-18.11 Lab Reports 3, 4, and 5 are Due	18
W, 03/21	*Quiz 7: Chapter 18* ***LAB 6****:* Coordination Compounds	
M, 03/26	Review **Exam 2: Chapters 16, 17, and 18**	
W, 03/28	Electrochemistry: Reading assignment Ch. 19.1-19.5 Lab Report 6 is Due	19
M, 04/02	**SPRING BREAK**	
W, 04/04	**SPRING BREAK**	
M, 04/09	Electrochemistry (continuation) Reading assignment Ch. 19.6-19.9	19
W, 04/11	***LAB 7****:* Electrochemistry *Quiz 8: Chapter 19*	19
M, 04/16	Nuclear Chemistry Reading assignment Ch. 21.1-21.5	21
W, 04/18	Nuclear Chemistry /continuation/ Reading assignment Ch. 21.6-21.10 Lab Report 7 is Due	21
M, 04/23	*Quiz 9: Chapter 21* Life and the Periodic Table Reading assignment Ch. 22.1-22.3 Last withdrawal date	22
W, 04/25	Life and the Periodic Table /continuation/ Reading assignment Ch. 22.4-22.5	22
M, 04/30	*Quiz 10: Chapter 22* Review	
W, 05/02	Review **Exam 3: Chapters 19, 21, and 22**	
M, 05/07	Course Review	
W, 05/09	**COMPREHENSIVE FINAL EXAM**	

GRADING POLICY:

Final course grades will be based on the following:

-	Laboratory work	$6 \cdot 2 = 12$ %
	best 6 out of 7 (the lowest graded one is dropped)	
-	Laboratory quizzes	$6 \cdot 1.5 = 9$ %
	(the lowest graded one is dropped)	
-	Active class participation	4 %
-	Homework	$8 \cdot 1 = 8$ %
-	Quizzes	$8 \cdot 2 = 16$ %
	best 8 out of 10 (the lowest scored two are dropped)	
-	Short quizzes	$14 \cdot 0.5 = 7$ %
-	Partial Examinations	$2 \cdot 12 = 24$ %
	best 2 out of 3 (the lowest scored exam is dropped)	
-	Comprehensive Final Exam	20 %
	Total	**100%**

Grading scale:

$A \geq 90$ %

$80 \leq B < 90$

$70 \leq C < 80$

$60 \leq D < 70$

$F < 60$

I incomplete

ADW will be given at the midterm to a student who (by the midterm date) would not fulfill the minimum requirements of active class participation pursuit

Methods of instruction

Instruction techniques include, but are not limited to, discussions, in-class small group problem solving activities, lectures, reading assignment, etc. Selected chapter outlines, highlights, and notes will be available on Blackboard.

Laboratory Activities: Pre-laboratory materials, procedures, and other instructions will be posted at blackboard or timely distributed in class in the form of hard copies. Students are expected to have reviewed these before coming to class. Some of these may be guided inquiry laboratory activities.

Group Exercises/Chem Activities: Chapter exercises and most laboratory experiments will be done as group work.

Video clips: Certain reactions and processes may be shown through short video clips.

Class Demonstrations: Live demonstrations of reactions and other processes may be done during both the lectures and laboratory work.

Methods of Assessment:

- Exams/Quizzes: There are three partial examinations multiple choice and free response questions) and a comprehensive final exam (multiple choice questions). Chapter quizzes will be given after completion of each chapter, roughly according to the tentative schedule. Quizzes and exams will be based on previously discussed material, on laboratory activities, and on material presented in the textbook. Besides, short unannounced open-notes quizzes will be occasionally given at the end of class period after reading assignment material was discussed in class and elaborated through problem solving small group in-class activities. There will be **no make up** for any missed exam, quiz, or short quiz. Two lowest scored quiz and one lowest scored partial exam will be dropped instead. A **Comprehensive Final Exam** will be given at the end of the semester.

  Cell phones and all other similar electronic devices (including lap tops) may absolutely not be used at any time during the exams and quizzes. They must be switched off and removed from the desks. After the beginning of the exam a students may leave the classroom only if he/she turns in the exam – no bathroom breaks are allowed.

  Notes: The final exam is absolutely mandatory. Students who do not attend the final exam will receive a grade of "F" for the course (fail the course). If such a student has a College recognized excuse, she or he will be given a grade of I (incomplete), which will be changed to a passing or filing grade depending on weather the final exam is completed in accordance with the deadline set by the College. Please consult student- handbook and your advisor regarding this matter.

- Laboratory: The evaluation of lab work will be based on:
  - Preparedness prior the lab session (including prelab question sheet); a short laboratory quiz will be given prior each lab session.
  - Performance during the lab session – (which also includes safety rules observance, general appearance/neatness of the lab desk during and after the performance of the experiment, reagent bottles and equipment handling, etc.); lab desk must be checked by the instructor before you live for the day.
  - Answers to prelab questions (turned in before the lab period), original data collected during the lab period and shown to the instructor at the end of the period, additional data that are result of your observation during the experiment, and answers to postlab questions if applicable (answers to postlab questions are due the next class period).
  - Lab reports must be written neatly in the appropriately signed lab notebook, or printed on neat paper sheets signed and stapled together. All lab reports must begin with title, name of student, names of lab partners, date of performance, and date of submission.
  - Any late lab forms will not be accepted.
  - Lab reports (all 3 parts) must be written neatly (please handprint) in ink or pen, not in pencil. Lab reports that are illegible or written in pencil will be graded with 0 points!
  - If a student presents fabricated data or "experimental" data copied from another student, both of the students will receive 0 points for this particular lab report.
  - A missed lab will be graded with 0 points and cannot be dropped.
  - There will be **no make up** for any missed lab or lab quiz.

- Active class participation: Students are expected to actively participate in class discussions, regularly do all assignments and take exams and quizzes, help classmates in gaining new knowledge, and/or ask classmates and the instructor for such help when needed.

- Homework: Homework assignments will be posted on line or on blackboard. They must be submitted on time. Any late homework will not be accepted.

***Course Policy*:**

Correspondence with Instructor: FERPA (Family Educational Rights and Privacy Act) is a federal law that protects the privacy of student educational records. See the following webpage: www.ed.gov/policy/gen/guid/fpco/ferpa/index.html. Faculty cannot reveal information about students, or discuss student records over the phone or unsecured e-mail. **CCC student e-mail** meets FERPA requirements and **must be used when communicating with the instructor after hours**.

Active Pursuit and Withdrawal: In order for you to remain enrolled in the course, you must actively pursue the completion of its objectives. A student will be withdrawn from the course (i.e., given a grade of ADW) at midterm if up to that point at least two of the following apply:

1. Less than 70% of the homework have been completed
2. Less than 70% of the labs and reports have been done and submitted
3. Less than 70% of the quizzes have been attempted
4. Less than 70% of the class sessions have been attended

The last day for student initiated withdrawal is on October 14th. Merely stopping from attending class beyond midterm does not constitute an official withdrawal. If your name appears in the final grade roster at the end of the semester and you have stopped attending long before then, you will receive a grade of 'F' for the course.

Student Conduct: Each student is responsible for adhering to the Standards of Conduct according to the Student Policy Manual (p. 41, http://www.ccc.edu/departments/Documents/studentpolicymanual.pdf)

All pagers and cellular phones must be turned off or put on the silent mode and put away during lecture and laboratory sessions. If you really have to take an emergency call, please live the classroom and take it in the hall. No CD/MP3/tape/music/iPod/iPhone is allowed to be operated while class is in session.

No eating, drinking, chewing gum, or smoking is allowed in the studio classroom.

Academic Integrity: Academic dishonesty is a serious offense, which includes but is not limited to the following: cheating, complicity, fabrication and falsification, forgery, and plagiarism. Cheating involves copying another student's paper, exam, quiz or use of technology devices to exchange information during class time and/or testing. It also involves the unauthorized use of notes, calculators, and other devices or study aids. In addition, it also includes the unauthorized collaboration on academic work of any sort. Complicity, on the other hand, involves the attempt to assist another student to commit an act of academic dishonesty. Fabrication and falsification, respectively, involve the invention or alteration of any information (data, results, sources, identity, and so forth) in academic work. Another example of academic dishonesty is forgery, which involves the duplication of a signature in order to represent it as authentic. Lastly, plagiarism involves the failure to acknowledge sources (of ideas, facts, charges, illustrations and so forth) properly in academic work, thus falsely representing another's ideas as one's own.

"The City Colleges of Chicago is committed to the ideals of truth and honesty. In view of this, students are expected to adhere to high standards of honesty in their academic endeavor. Plagiarism and cheating of any kind are serious violations of these standards and will result, minimally, in the grade of "F" by the instructor." – p. 40 of the Student Policy Manual (http://www.ccc.edu/departments/Documents/studentpolicymanual.pdf)

Academic Support Services:

Tutoring Center. For students who need help with their assignments: Larry McKeon Administrative Building ("New Building") Room 162, 773-907-4785, http://www.ccc.edu/colleges/truman/departments/Pages/Tutoring.aspx

Student Success and Leadership Institute (SSLI). For students who need various other support services to achieve their educational goals: Larry McKeon Administrative Building ("New Building") Room 162,, http://www.ccc.edu/colleges/truman/departments/Pages/Student-Success-and-Leadership-Institute.aspx.

Disability Access Center. The Center verifies needs pursuant to the American Disabilities Act (ADA). It determines student academic accommodations, and issues accommodation letters. Registration is required at the start of each semester. http://www.ccc.edu/colleges/truman/departments/Pages/Disability-Access-Center.aspx.

Your success in this class is important to me. If you have any concern about participating or accomplishing the required course work because of a disability or medical condition, please see me after class or during my office hours. You should also visit the Disability Access Center. The center at Truman College was created to meet the needs of students with disabilities. The short-term goal is to help you develop learning techniques that ensure your success at Truman College. Long-term, Disability Access Center services are designed to help you make the transition from college to work. Students must obtain written permission from this office before any specific accommodations for disabilities are afforded.

Contact Information:
Ms. Linda Ford, director
E-mail: lford@ccc.edu
Larry McKeon Administrative Building ("New Building") Room 162Q,
Tel (773) 907-4725
Hours: Mon-Thr 9:00 AM to 7:00 PM and Fri 9:00 AM to 4:00 P

Additional Instructions for the Laboratory Work

1. No eating, drinking, chewing gum, or smoking in the room.
2. Study the experiment carefully before coming to class so that you don't waste time going through the procedure during the lab. **NO MAKE UP LABS**.
3. You must do your own work unless you are told to work in pairs for an experiment. If you need guidance, let the instructor know.

4. **RECORD ALL DATA IN INK IN YOUR LAB DATA SHEET WHILE YOU WORK.** Do not write data, even temporarily, on scraps or other pieces of paper. **Do not forget your name or the number of the unknown substance**, if applicable. Pay attention to significant figures and units. If you make a mistake, delete entries by crossing them out neatly with a single line. Do not erase or "white out" mistakes. **BEFORE LEAVING THE LABORATORY, HAVE THE LABORATORY INSTRUCTOR SIGN YOUR REPORT SHEET.**

5. Children are not allowed in the lab.

6. **ALWAYS WEAR YOUR SAFETY GLASSES.** Failure to wear your safety glasses will lead to dismissal from lab and a lowered grade for that experiment.

7. **WEAR SENSIBLE CLOTHING** as discussed during the safety lecture. If you wear shorts, sandals, or other clothing that is not consistent with safety, you will not be admitted to the laboratory. Wearing a lab apron or a lab coat is recommended.

8. Do not take reagent bottles to your bench. Use test tubes, beakers, or weighing boats to obtain chemicals from the dispensing area. Take small quantities of reagents. You can always get more if you run short.

9. Check carefully the label on each reagent bottle to be sure you have the correct reagent. The names or chemical formulas of many substances appear similar at first glance.

10. To avoid possible contamination, never return unused chemicals to the reagent bottles.

11. Do not insert your medicine droppers into reagent bottles. Instead pour a little of the liquid into a small beaker or small test tube.

12. Be neat in your work; if you spill something, clean it up immediately.

13. Wash your hands anytime you get chemicals on them and at the end of the laboratory period.

14. After completing the experiment, clean and put away your glassware and equipment. Clean your work area and make sure the gas and water are turned off. A clean lab is a safe lab.

15. Dispose solid waste such as filter paper and litmus paper in the wastebasket, not in the sink. Dispose broken glass in the broken glass waste boxes. Dispose all other solid chemicals as directed by your instructor. Pour all the toxic liquids into the waste bottles provided or as directed by instructor.

16. Keep the mass balances and the area around them clean. Follow the directions given by the instructor on the proper weighing technique to use. Do not place chemicals directly on the balance pans; place a piece of weighing paper or a small container on the pan first, and then weigh your material. Never weigh an object while it is hot.

17. Do not heat graduate cylinders, burettes, pipets, or bottles with a burner flame.

18. Do not look down into the open end of a test tube in which the contents are being heated or in which a reaction is being conducted.

19. Do not perform unauthorized experiments.

Recommended Links to support students' learning

For some very interesting and useful web links please visit Professor Joy Walker's site
http://justonly.com/chemistry/chem203/index.php

You may also find helpful some of the following links:
www.chemreview.net

www.chemicool.com