



DEPARTMENT OF PHYSICAL SCIENCES & ENGINEERING

MASTER SYLLABUS

Chemistry 203 (General Chemistry-II)

Harry S. Truman College: 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.

Course (Discipline): Chemistry 203

IAI Code – CHM 912

1. Title, Number, and Classification

General Chemistry-II (Chem. 203)

2. Course Term

16 week Semester or 8 week summer term

3. Credit and Contact Hours

Credit hours: 5

Contact hours: 4 lecture & 4 laboratory

4. Prerequisites

Grade of C or better in Chemistry 201 and in mathematics 140 or 143, or consent of department chair (CCC)

5. Catalog Description

Topics include 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.

6. Students for whom the course is intended

Students may take this course to meet concentration or elective requirements for an associates degree, to fulfill requirements for a career occupational degree, or to prepare for other careers in the physical sciences or healthcare professions.

7. Course Objectives

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 K_a 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. Predict the physical properties, geometry and hybridization of coordination compounds.

Nuclear Chemistry

46. Describe the structure of the nucleus.
47. Define alpha and beta particles and gamma radiation.
48. Use isotopic notation to write a nuclear reaction.
49. Discuss the kinetics of radioactive decay and the meaning of half-life.
50. Discuss the detection of radiation.
51. Discuss radioactive dating.
52. Give examples of medical applications of nuclear chemistry.
53. Differentiate between nuclear fusion and nuclear fission.
54. Discuss the health effects of radiation.
55. Define rems and rads.

General

56. Maintain a detailed laboratory notebook.
57. Write professional laboratory reports.
58. Discuss applications of these chemistry topics to the world at large

8. Learning Outcomes

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

1. Compare and contrast the chemical behavior and reactions of common substances
 2. Collect quantitative data and organize it into meaningful charts and graphs
 3. Discuss industrial processes for manufacture of major inorganic chemicals.
 4. Solve kinetic and equilibrium problems.
 5. Analyze experimental data and draw appropriate conclusions from data and chemistry theories.
 6. Write a formal laboratory report.
9. **Topical Course Outline** (suggested)

Week	Topic	Text Reference
Week 1	Lecture: Course Introduction, Main Group Elements: Alkali Metals	Chapter 21
	Lecture: Main Group Elements: Alkaline Earth Metals, Boron Family	Chapters 21

Week 2	Lecture: Main Group Elements: Carbon Family, Noble Gases, Halogens	Chapter 22 Chapter 14
	Lecture: Main Group Elements: Oxygen Family, Hydrogen	Chapter 14 Download pdf
Week 3	Lecture: Chemical Kinetics: First-Order and Second-Order Reactions LAB: Check-In, Reaction Rates and Activation Energy	Chapter 14 Download pdf
	Lecture: Chemical Kinetics - Models, Effect of Temperature, Reaction Mechanisms, Catalysis	Chapter 14
Week 4	Exam One: Chem One Review, Main Group Elements, Chemical Kinetics Chemical Equilibrium; Dynamic Equilibrium, The Equilibrium Constant, The Reaction Quotient, Le Châtelier's Principle	Chapter 15
	Lecture: Equilibrium; Reaction Conditions LAB: Chemical Equilibrium - Le Châtelier's Principle	Chapter 15 Download pdf
Week 5	Lecture: Acids and Bases	Chapter 16
	Lecture: Acids and Bases LAB: Determination of Equilibrium Constant by Spectrophotometry	Chapter 17 Download pdf
Week 6	Lecture: Acid/Base Equilibria LAB: Properties of Buffers	Chapter 17 Download pdf
	Lecture: Solubility	Chapter 18
Week 7	Lecture: Complex Ion Equilibria LAB: Measuring the Solubility Product of Silver Chromate	Download pdf
	Exam Two: Chemical Equilibria, Acids and Bases	
Week 8	Lecture: Thermodynamics	Chapter 19
	Lecture: Thermodynamics	Chapter 19
Week 9	LAB: Determination of the Thermodynamic Parameters for the Solvation of Borax Lab Notebook and First Lab Report is Due!	Download pdf
	Lecture: Electrochemistry	Chapter 20
Week 10	Lecture: Electrochemistry	Chapter 20
	Problem Solving Practice LAB: Electrochemistry	Download pdf
Week 11	Exam Three: Thermodynamics and Electrochemistry	
	Lecture: The Transition Elements (Class will take place at Harold Washington College) We will analyze fish for mercury content.	Chapter 23 Download pdf
Week 12	Lecture: Coordination Compounds Exam II retake.	Chapter 24
	Lecture: Nuclear Chemistry	Chapter 25

Week 13	Problem Solving Practice LAB Coordination Compounds	Download pdf
	Exam Four: Transition Elements, Coordination Compounds, Nuclear Chemistry	
Week 14	Course Review Lab Notebook and Second Lab Report is Due!	
Week 15	LAB: Check Out and Clean Up ALL ASSIGNMENTS ARE DUE	
Week 16	Comprehensive Final Exam	Chapters 14 to 25

10. Texts and Materials (suggested)

General Chemistry 10th Ed. by Petrucci, Herring, Madura, Bissonette, Pearson ©2011,
ISBN: 978-0-13-206452-1

Mastering Chemistry

*If you don't already have this textbook please note: we have created a paperback edition of Volume Two of our textbook for a considerably lower price. It begins with Chapter 14. You will find it in Beck's Bookstore.

All laboratories will be available to download from this website. There is no laboratory textbook to purchase.

11. Methods of Instruction

Lecture and Notes: Lecture notes will be in the form of PowerPoint presentations and overhead sheets. These will be posted on Blackboard and/or websites.

Group Exercise: Documents on instructions and methodologies will be provided by the instructor. This will include group discussions, presentations, and writing.

Videos/CDs: The instructor will show or provide cd roms as deemed necessary.

12. Methods of Evaluation:

Your Grade will be based on:

Laboratory notebook (10%)

Two laboratory formal reports (10%)

Laboratory results (10%)

Examinations [best three of four] (30%)

Homework, class activities, class participation and attendance (20%)

Comprehensive final exam (20%)

Letter Grade

A

B

C

D

F

I

ADW

NSW

Percentage

90%

80%

70%

60%

Below 60%

*Incomplete

** Administrative Withdrawal

***No Show Withdrawal

***I (Incomplete)** is a non-grade received by students who have **actively pursued** the course and are doing passing work at the end of the course, but who have not completed the course's final examination and/or other specific course assignments.

****ADW (Administrative Withdrawal)** is given to any student who is not **actively pursuing** the course objectives will be administratively withdrawn from the course at mid-term. An ADW will be given if a student does not complete at least 70% of all assignments; homework, exams, laboratories, quizzes due prior to mid-term by the mid-term date. Since make up work is NOT permitted this means that attendance is extremely important and excessive absences will most likely result in an ADW.

*****NSW (No Show Withdrawal)** is given to any student who misses the first two classes and does not discuss with me the circumstances of these absences will be given an NSW after the second class. A student who attends the first class and then fails to attend the next two classes and fails to discuss with me the circumstances of these absences will be given an NSW. Any student who misses more than half of the classes in the first two weeks of the term will also be given an NSW if we do not discuss the circumstances of these absences. In my discussion with you I will determine if it is feasible for you to successfully pursue the course objectives under whatever circumstances are causing you to miss class. Your success is very important to me and I know, from years of experience, that your success depends on your commitment and ability to attend the class and participate in all activities.

Authorized Signature and File

Date: _____