SYLLABUS

CHE*K122 General Chemistry II
Three Rivers Community College
Norwich, CT 06360

Michael P. Carta, Instructor of Chemistry

Office: C168

Office Phone: 860-885-2385

Email: mcarta@trcc.commnet.edu

Office Hours: MW 1:00-2:00
T 2:30-3:30

**********Special Notice**********

If you have a visible or hidden disability which may require classroom, lab, and/or test-taking modifications, please see me as soon as possible. If you have not registered with Chris Scarborough, learning specialist at (860) 823-2985 or a counselor in the Student Services Development Center, you must do so early in the semester.

Course: General Chemistry II/CHE*K122

Credits: 4 credit hours (3hr lecture/3hr lab each week)

Course Description: Further study of the principles, theories and laws of chemistry. Topics include kinetics, equilibrium, thermodynamics, oxidation-reduction, electrochemistry, organic chemistry, nuclear chemistry and the chemistry of the elements and their compounds.

Prerequisites: CHE*K121 with a "C" grade or better, MAT* K186 with a "C" grade or better.

Text: *Chemistry*, 10th ed., Chang, McGraw-Hill.

Lab Manual: *Chemical Principles in the Laboratory*, 9th ed., Slowinsky and Wolsey, Brooks/Cole.

Other Required Materials: Chemical safety goggles, scientific calculator.

General Course Objectives:

1. To provide students with a solid understanding of the fundamental concepts of chemistry.
2. To encourage students to apply problem-solving skills toward chemical calculations.
3. To educate students in the language and nomenclature of chemistry.
4. To help students relate chemical concepts to practical applications.

Class Attendance Policy:

Attendance of all class activities in lecture and laboratory is required. Absences are counted from the first meeting of class. More than four consecutive or more than six accumulative absences could result in a student receiving an "F" grade in this course. An explanation of the cause of all absences should be given to your instructor.

Academic and Classroom Misconduct:

The instructor has primary responsibility for control over classroom and/or laboratory behavior and maintenance of academic integrity, and can request the temporary removal or exclusion from the classroom or laboratory of any student engaged in conduct that violates the general rules and regulations of the institution. Or any student engaged in conduct deemed hazardous in the laboratory. Extended or permanent exclusion from lecture or laboratory activities or further disciplinary action can only be effected through appropriate procedures of the institution. Plagiarism, cheating on quizzes or tests, or any form of academic dishonesty is strictly prohibited. Students guilty of academic dishonesty directly or indirectly will receive a zero for the exercise or quiz or test and may receive an "F" grade for the course in addition to other possible disciplinary sanctions which maybe imposed through the regular institutional procedures. Any student that believes that he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected.

College Withdrawal Policy:
Any student who finds it necessary to discontinue this course MUST complete a withdrawal form in the Registrar's Office at the time of the withdrawal. Students may withdraw from the course any time during the 14 weeks of class to receive a "W" grade for the course (Deadline will be announced). Students who do not withdraw, but stop attending will be assigned an "F" grade in in this course. Verbal withdrawals CANNOT be accepted. If you are unable to withdraw in person, you may call the Registrar's Office and provide them with the appropriate information. *Once you withdraw from the course you are no longer eligible to attend class or take any remaining quizzes or tests.*

Revisions to the Syllabus:
Students are responsible for learning all of the objectives and all of the items in the course outline whether they are discussed in lecture and/or laboratory or not. The instructor reserves the right to revise the objectives, topical outline, or academic schedule contained in this syllabus without notice. However, if the revisions affect scheduled unit tests a 48-hour notice will be given for the new test date.

Grade Determination:
4 Unit Tests……75%
Lab (reports, lab midterm, lab final)……..25%

Grade Scale: There will be no grading on the normal distribution curve.

100.00 - 93.50 = A	79.49 - 77.50 = C+	59.49 - 00.00 = F
93.49 - 90.00 = A-	77.49 - 73.50 = C	
89.99 - 87.50 = B+	73.49 - 69.50 = C-	
87.49 - 84.50 = B	69.49 - 63.50 = D+	
84.49 - 79.50 = B-	63.49 - 59.50 = D	

Make-Ups:
Any assignment missed can be obtained from the instructor. Lab work may be made up during free lab time within a week of the missed assignment if the lab is available. Unit tests can only be made up by special arrangement with the instructor. Makeup tests will be granted on an individual basis only following a conference with the instructor, where the reason(s) for missing the test must be determined mitigating circumstances beyond the control of the student such as, illness, death in the family, or change in condition of employment. If two unit tests are missed during the semester and/or if the final exam is missed the student will receive a "F" grade if he or she is failing other parts of the course or an "I" if the student is passing all other parts of the course.

Cellular Phones and/or beepers: ***Cellular phones and beepers are only allowed in class or lab if they are turned off or in silent mode. Under no circumstances are phones to be answered in class. When there are extenuating circumstances that require that a student be available by phone or beeper, that student must speak to the instructor prior to class, so that together they can arrive at an agreement.***

Course Objectives: CHE*K122- General Chemistry II

1. The student will learn about the factors which affect the rate of chemical reaction.
2. The student will be able to write a rate law.
3. The student will understand the meaning of reaction order.
4. The student will learn how to calculate the half-life for a reactant.
5. The student will be able to understand the meaning of activation energy.
6. The student will learn about different types of catalysts and how they function.
7. The student will be able to calculate the instantaneous and the average reaction rate.
8. The student will be able to understand the concept of reaction mechanism.
9. The student will be able to define enzymes and understand basic enzyme catalysis.
10. The student will be able to define chemical equilibrium.
11. The student will learn how to write an equilibrium expression.
12. The student will learn how to interpret the equilibrium constant.
13. The student will be able to understand the relationship between kinetics and equilibrium.
14. The student will learn how to calculate equilibrium concentrations of reactants and products.
15. The student will understand LeChatelier's principle and factors which affect equilibrium.
16. The student will learn the definitions of acids and bases.
17. The student will learn how to determine the strength of acids and bases.
18. The student will be able to define pH and calculate the pH of acid or base solutions.
19. The student will be able to understand weak acids and the acid ionization constant.
20. The student will learn how to calculate the pH of a weak acid or base solution.
21. The student will be able to understand the concept of Lewis acids and bases.
22. The student will learn how to determine the acid-base properties of salts.
23. The student will be able to understand how titrations are used to quantitate acids and bases.
24. The student will learn how acid-base indicators are used.
25. The student will be able to define a buffer and learn how buffers work.
26. The student will learn how to use the Henderson-Hasselbalch equation.
27. The student will be able to understand the concept of solubility equilibria.
28. The student will learn the definition of the solubility product, K_{sp}.
29. The student will be able to understand the common ion effect.
30. The student will be able to understand the laws of thermodynamics.
31. The student will be able to differentiate spontaneous from nonspontaneous processes.
32. The student will be able to define entropy.
33. The student will be able to understand the concept of free energy.
34. The student will learn how to predict spontaneity based on the free energy change, ΔG.
35. The student will learn about the relationship between the equilibrium constant and free energy.
36. The student will be able to understand the relationship between enthalpy, entropy and free energy.
37. The student will be able to understand how equilibrium and free energy are central to living systems.
38. The student will learn how to balance redox equations.
39. The student will be able to understand the basics of galvanic cells.

40. The student will learn the significance of standard reduction potentials.
41. The student will be able to write half-cell reactions.
42. The student will be able to understand the thermodynamics of redox reactions.
43. The student will be able to define the Faraday constant.
44. The student will learn how to use the Nernst equation.
45. The student will be able to understand how batteries work.
46. The student will learn how an electrolytic cell works.
47. The student will be able to understand corrosion of metals.
48. The student will learn the basics of atmospheric chemistry.
49. The student will be able to understand the phenomenon of acid rain.
50. The student will be able to understand the greenhouse effect.
51. The student will be able to understand various aspects of environmental chemistry including smog.
52. The student will learn the definition of a coordination compound.
53. The student will be able to define coordination number, ligand, and chelating agent.
54. The student will learn the basic nomenclature of coordination compounds.
55. The student will be able to understand the bonding in coordination complexes.
56. The student will learn how coordination chemistry applies to biological systems.
57. The student will learn the basic nomenclature of organic compounds.
58. The student will be able to distinguish between types of organic compounds.
59. The student will be able to define and differentiate between geometric, optical and regioisomers.
60. The student will be able to predict the physical and chemical properties of various organic compounds.
61. The student will be able to differentiate between the different types of nuclear particles.
62. The student will be able to understand the fundamentals of nuclear reactions.
63. The student will be able to understand the basis of nuclear stability.
64. The student will be able to write and balance nuclear equations.
65. The student will learn the definition of nuclear binding energy.
66. The student will be able to understand natural radioactivity and half-life of radioactive decay.
67. The student will be able to understand the concept of nuclear transmutation.
68. The student will be able to understand the concept of nuclear fission.
69. The student will learn how radioactive isotopes are used in biology and medicine.
70. The student will learn about the chemistry of metals and nonmetals in greater detail.

Course Outline: CHE*K122- General Chemistry II

UNIT 1

I. Chemical Kinetics
    A. Reaction Rate
        1. factors affecting reaction rate
        2. measuring reaction rates
            a. instantaneous rate
            b. average rate
            c. rate constants
        3. rate law
        4. reaction order
        5. half-life
    B. Activation Energy and Collision Theory
        1. transition state
        2. Arrhenius equation for determining E_{act}
    C. Reaction Mechanism
        1. elementary steps
        2. rate-determining step
        3. reaction intermediates
        4. molecularity
            a. unimolecular, bimolecular and termolecular reactions
    D. Catalysts
        1. homogeneous catalysts
            a. enzymes
        2. heterogeneous catalysts
            a. Haber process
            b. catalytic converters
            c. catalytic hydrogenation
II. Chemical Equilibrium
    A. Law of Mass Action
        1. Equilibrium Constant
    C. Equilibrium Expressions
        1. homogeneous equilibria
        2. heterogeneous equilibria
        3. K_c vs. K_p
        4. multiple equilibria
    D. Relationship between Kinetics and Equilibrium
    E. Reaction Quotient, Q_c
    F. LeChatelier's Principle
        1. factors affecting equilibrium

UNIT 2

I. Acids and Bases
  A. Definitions/Theories
    1. Arrhenius
      a. hydronium ion
    2. Bronsted-Lowry
      a. conjugate acid-base pairs
    3. Lewis
  B. Properties of Acids and Bases
  C. Ion Product of Water
    1. K_w
    2. pH, pOH
  D. Strengths of Acids and Bases
    1. acid ionization constant K_a; percent ionization
    2. monoprotic, diprotic, polyprotic acids
    3. molecular structure and acid strength
  E. Acid-Base Properties of Salts
  F. Acid-Base Properties of Oxides and Hydroxides
    1. acidic and basic oxides
    2. basic and amphoteric hydroxides
  G. Organic Acids and Bases
    1. carboxylic acids
    2. amines
II. Acid-Base Equilibria
  A. Common Ion Effect
    1. Henderson-Hasselbalch equation
    2. pKa
  B. Buffers
    1. importance in biological systems
  C. Acid-Base Titrations
    1. strong acid-strong base
    2. strong acid-weak base
    3. weak acid-strong base
    4. indicators
III. Solubility Equilibria
  A. Solubility Product
    1. K_{sp}
    2. ion product, Q
    3. solubility
    4. molar solubility
  B. Precipitation Reactions
    1. fractional precipitation
    2. qualitative analysis
  C. Factors Affecting Solubility
    1. common ion effect

2. pH effect

D. Complex Ions

UNIT 3

I. Second Law of Thermodynamics
   A. Entropy
      1. spontaneous processes
      2. microstates
      3. standard entropy
      4. relationship between ΔS and ΔH
II. Third Law of Thermodynamics
   A. Absolute Entropy
   B. Gibbs Free Energy (G)
      1. standard free energy change, ΔG°
      2. relationship between ΔG, ΔS and ΔH
         a. predicting the sign of ΔG
III. Free Energy and Equilibrium
   A. $\Delta G = -RT\ln K$
   B. Application of Thermodynamics in Biological Systems
      1. glycolysis
      2. biosynthesis
IV. Electrochemistry
   A. Oxidation-Reduction Reactions
      1. balancing redox equations
   B. Galvanic Cells
      1. anode, cathode
      2. half-cell reactions
      3. cell potential or emf
      4. Daniel cell
      5. standard reduction potentials
   C. Thermodynamics of Redox Reactions
      1. relationship between E_{cell}, ΔG and K
   D. Effect of Concentration on E_{cell}
      1. Nernst equation
   E. Batteries
      1. dry cell battery
      2. mercury battery
      3. lithium ion battery
      4. lead storage battery
   F. Fuel Cells
   G. Corrosion
   H. Electrolytic Cells and Electrolysis
V. Environmental Chemistry
   A. Chemistry of the Atmosphere
      1. troposphere, stratosphere, mesosphere, ionosphere (thermosphere)

2. nitrogen cycle
3. oxygen cycle
4. ozone
5. CFC's

B. Volcanoes
C. Greenhouse Effect
1. greenhouse gases
D. Acid Rain
E. Smog and Emissions
F. Water
G. Alternative Fuels

VI. Chemistry of Nonmetals
A. Carbon, Nitrogen, Oxygen, Sulfur, Phosphorus and the Halides

UNIT 4

I. Chemistry of Metals
A. Sources/Production
1. minerals
2. ores
3. alloys
B. Band Theory
1. conductors and semiconductors

II. Transition Metal Chemistry
B. Electron Configurations
C. Coordination Chemistry
1. coordination number
2. donor atom
3. ligand
4. chelating agent
2. nomenclature
3. structure
4. isomerism
a. geometric isomers, optical isomers, chirality
5. bonding
a. crystal field theory
6. reactivity
7. applications of coordination chemistry
a. industrial
b. biological

III. Organic Chemistry
A. Classes of Compounds/Nomenclature
1. aliphatic hydrocarbons
a. alkanes, alkenes, alkynes, alicyclic hydrocarbons

2. aromatic hydrocarbons
    a. benzene and related compounds

B. Functional Groups
1. alcohols
2. carboxylic acids
3. amines
4. amides
5. aldehydes
6. ketones
7. esters
8. ethers

C. Physical and Chemical Properties
1. mp, bp, solubility
2. reactivity

D. Isomers
1. cis/trans isomers
2. regioisomers
3. optical isomers and chirality

IV. Nuclear Chemistry

A. Subatomic Particles
1. protons, neutrons, electrons
2. beta particles, alpha particles, positrons

B. Fundamentals of Nuclear Reactions
1. radioactive decay
2. nuclear transmutation
3. conservation of atomic number
4. conservation of mass number

C. Nuclear Stability
1. belt of stability
2. nuclear binding energy

D. Kinetics of Radioactive Decay
1. half-life
2. radiocarbon dating

E. Nuclear Fission
1. critical mass
2. nuclear chain reaction
3. nuclear reactors

F. Uses of Radioisotopes
1. mechanistic studies
2. biology and medicine

CHE*K122 General Chemistry II Tentative Academic Schedule Spring 2011
10234 Lecture: TR 1:00-2:25 p.m. D210
10235 Lab: R 9:00-12:00 p.m. B222

week 1
R-Jan 20 9:00 a.m. LAB: Syllabus, Orientation, Lab Safety and Procedures
1:00 p.m. Review; Kinetics Ch 13. Problems: 6, 15, 16, 26, 37, 43, 45, 51, 65, 100.

week 2
T-Jan 25 1:00 p.m. Kinetics Ch 13 cont'd.
R-Jan 27 9:00 a.m. *LAB: Rates of Chemical Reactions I- Iodination of Acetone (# 20).*
1:00 p.m. Kinetics Ch 13 cont'd.

week 3
T-Feb 1 1:00 p.m. Kinetics/Equilibrium Ch 14. Problems Ch 14: 8, 14, 20, 24, 26, 42, 54, 55, 64, 88.
R-Feb 3 **PROFESSIONAL DAY- NO CLASS**

week 4
T-Feb 8 1:00 p.m. Equilibrium Ch 14 cont'd.
R-Feb 10 9:00 a.m. *LAB: Rates of Chemical Reactions II- A Clock Reaction (# 21).*
1:00 p.m. Equilibrium Ch 14 cont'd.

week 5
T-Feb 15 1:00 p.m. Equilibrium Ch 14 cont'd.
R-Feb 17 9:00 a.m. *LAB: Determination of the Equilibrium Constant for a Chemical Reaction (# 23).*
1:00 p.m. Ch 13/14 review for test.

week 6
T-Feb 22 1:00 p.m. **UNIT TEST 1 (Ch 13, 14).**
R-Feb 24 9:00 a.m. *LAB: pH and Buffers (handout).*
1:00 p.m. Acids and Bases Ch 15/24. Problems (Ch 15): 5, 25, 36, 42, 48, 53, 56, 68, 70, 74, 76, 79, 80, 83.

week 7
T-Mar 1 1:00 p.m. Acids and Bases Ch 15/24 cont'd.
R-Mar 3 9:00 a.m. *LAB: Preparation of Aspirin (# 41).*
1:00 p.m. Acid-Base Equilibria, Solubility Equilibria Ch 16. Problems: 10, 14, 15, 16, 28, 31, 32, 50, 54, 55, 62, 76.

week 8
T-Mar 8 1:00 p.m. Acid-Base Equilibria, Solubility Equilibria Ch 16 cont'd.
R-Mar 10 9:00 a.m. **LAB MIDTERM**
1:00 p.m. Acid-Base Equilibria, Solubility Equilibria Ch 16 cont'd.

week 9
T-Mar 15 **SPRING BREAK**
R-Mar 17 **SPRING BREAK**

week 10
T-Mar 22 1:00 p.m. Ch 15/24, 16 review for test.
R-Mar 24 9:00 a.m. *LAB: Analysis for Vitamin C (# 43).*
1:00 p.m. **UNIT TEST 2 (Ch 15/24, 16**)

week 11
T-Mar 29 1:00 p.m. Entropy, Free Energy and Equilibrium Ch 18. Problems: 5, 12, 14, 18, 28, 35, 68.
R-Mar 31 9:00 a.m. *LAB: Determination of the Hardness of Water (# 28).*
1:00 p.m. Entropy, Free Energy and Equilibrium Ch 18 cont'd.

week 12
T-Apr 5 1:00 p.m. Entropy, Free Energy and Equilibrium Ch 18 cont'd.
R-Apr 7 9:00 a.m. *LAB: Molar Solubility and Ksp.*
1:00 p.m. Electrochemistry Ch 19. Problems: 2, 12, 16, 22, 29, 32, 57.

week 13
T-Apr 12 1:00 p.m. Electrochemistry Ch 19 cont'd.
R-Apr 14 9:00 a.m. *LAB: Determination of Iron by Redox Titration (# 30).*
1:00 p.m. Chemistry in the Atmosphere/Chemistry of Nonmetals Ch 17/Ch 21.
Problems: 17.40, 17.66, 21.76.

week 14
T-Apr 19 1:00 p.m. Chemistry in the Atmosphere/Chemistry of Nonmetals Ch 17/Ch 21 cont'd.
R-Apr 21 9:00 a.m. **UNIT TEST 3 (Ch 17, 18, 19, 21).**
1:00 p.m. Chemistry of Metals Ch 20/22. Problems: 20.16, 22.16, 22.18, 22.26, 22.35.

week 15
T-Apr 26 1:00 p.m. Chemistry of Metals Ch 20/22 cont'd.
R-Apr 28 9:00 a.m. *LAB: Thin-Layer Chromatography (handout).*
1:00 p.m. Organic Chemistry Ch 24. Problems: 14, 25, 36, 56, 60, 66.

week 16
T-May 3 1:00 p.m. Organic Chemistry Ch 24 cont'd.
R-May 5 9:00 a.m. *LAB: Preparation of Soap (handout).*
1:00 p.m. Organic Chemistry Ch 24 cont'd.

week 17
T-May 10 1:00 p.m. Nuclear Chemistry Ch 23. Problems: 6, 24, 26, 28, 34, 54, 57, 58.
R-May 12 9:00 a.m. **LAB FINAL**
1:00 p.m. Nuclear Chemistry Ch 23 cont'd.

week 18
T-May 17 1:00 p.m. **UNIT TEST 4 (Ch 20, 22, 23, 24).**