SYLLABUS

CHE*K121 General Chemistry I
Three Rivers Community College
Norwich, CT 06360

David L. Cullen

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Office Hours: TR 3:30-4:45
Others to be determined

**********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.

31190/Fall 2010

Course: General Chemistry I/CHE*K121

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

Course Description: A study of the fundamental principles, theories and laws of chemistry. Topics include measurements, states of matter, atomic theory and structure of the atom, periodic properties of the elements, kinetic molecular theory, gases, chemical equations, enthalpy, stoichiometry, chemical bonding, molecular geometry, solutions and colloids.

Prerequisites: Placement test score indicating ENG K101 or successful completion of ENG K100 with a "C" grade or better and successful completion of MAT K137 and high school chemistry or CHE K111 with a "C" grade or better or permission of the instructor or department chairperson.
Co-requisite: MAT K186

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.

Classs Attendance Policy:
There is no formal attendance policy for lectures. However keep in mind that missing one day of lecture iis the same as missing a entire week. Students are responsible for all material covered in lecture whether or not it is in the textbook. Examinations are based on the material covered in lecture.. The instructor will be disinclined to "give a break" in borderline situations to students who have excessive absences without acceptable excuses.

Attendance at all laboratory sessions is required unless there are acceptable mitigating circumstances. See section on make-ups below. 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. The same is true for 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:
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:

3 Unit Tests	39%	130 points each	390 points
Final Examination (Cumulative)	26%		260 points
Problem Sets	10%		100 points
2 Lab Tests	12%	60 pts each	120 points
Lab reports	13%		130 points
			1000 points

A more detailed break down of the points for laboratory reports will be provided later.

Grade Scale
The following is a somewhat "relaxed" version of the usual grading scale. There will be no grading on the normal distribution curve. At the discretion of the instructor, the specified limits may be varied somewhat at the discretion of the instructor. The limits will never be moved upward.

100.00 - 92.00 = A	76.99 - 74.00 = C+	54.99 - 00.00 = F
91.99 - 88.00 = A-	73.99 – 69.00 = C	
87.99 – 85.00 = B+	69.99 – 65.00 = C-	
84.99 - 82.00 = B	64.99 - 62.00 = D+	
81.99 - 77.00 = B-	61.99 – 55.00 = D	

Problem Sets:
Required problem sets will be distributed on Tuesdays except for the weeks before examinations. These will be due the following Tuesday by the end of lecture. They may turned inn as late as the end of laboratory on the following Thursday with a 10% penalty applied.. No problem sets will be accepted after that pint. Supplementary problem sets may be given I the weeks before examinations, but this will not be collected or

graded. Grades will be given both as a raw score and as a percentage. The percentage score will be averaged to give the overall problem set point grade. If there are acceptable mitigating circumstances for a missed problem set, that problem set will not be included in the average. If there is no such mitigating circumstance, a percentage grade of 0 will be recorded. Collaborative efforts are permitted, but simply copying somebody's problem set is not.

Make-Ups:
Any assignment missed can be obtained from the instructor. Lab work may be made during the lab time for one of the other sections of Chemistry 121 if space is available. Makes up of unit tests must be arranged through the instructor. Students have the option of taking one unit test during the semester later than scheduled. In such cases the examination must be completed by the following Friday. You should inform the instructor if you wish to exercise this option. Further requests for extensions must be for extremely compelling and legitimate reasons. . "I need to study more" or "I'm not prepared" are NOT considered valid reasons for further extensions.

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. Sending or receiving text messages in class is disrespectful to the instructor and other students and is similarly prohibited 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.***

Couse Objectives: CHE K121- General Chemistry I

1. The student will be able to convert English to metric units and vice versa.
2. The student will learn how to report a result to the correct number of significant figures.
3. The student will learn the difference between elements, compounds, solutions and heterogeneous mixtures.
4. The student will be able to determine the number of protons, neutrons and electrons in atoms or ions of a given isotope.
5. The student will be able to distinguish between metallic and nonmetallic properties.
6. The student will be able to distinguish between mass and weight.
7. The student will become familiar with the SI units of mass, volume, length, area, pressure, density, force and energy.
8. The student will learn the proper use of volumetric equipment in the laboratory.
9. The student will learn proper use of balances to measure mass.
10. The student will be able to determine the number of atoms, ions or molecules in a given mass of substance.
11. The student will become familiar with the terms cation, anion and polyatomic ion.
12. The student will be able to determine oxidation numbers.
13. The student will learn both systematic and common naming conventions for inorganic compounds.

14. The student will learn how to determine empirical formula.

15. The student will learn the concept of structural formula and how to write Lewis structures.

16. The student will learn how to determine molecular formula from empirical formula and molar mass.

17. The student will be able to work with the following concentration units: molarity, molality, % by mass, % by volume, parts per million.

18. The student will be able to write and balance chemical equations.

19. The student will be able to distinguish between various reaction types such as synthesis, decompostion, displacement, oxidation-reduction and acid-base neutralization.

20. The student will be able to perform stoichiometric calculations to determine limiting reagent, theoretical and percent yield.

21. The student will understand the differences between acids and bases, including the concept of pH.

22. The student will learn how to interpret the periodic table and be able to predict periodic properties.

23. The student will be able to perform calculations involving the gas laws.

24. The student will be able to understand the basic energy relationships in endothermic and exothermic processes and be able to perform calculations involving energy changes, including calorimetry.

25. The student will be able to understand basic atomic theory including early models of the atom.

26. The student will be able to understand the concept of atomic orbitals and the rules of orbital filling.

27. The student will learn how to write electron configurations using the periodic table.

28. The student will be able to understand the definition of quantum numbers and how they relate to electronic structure.

29. The student will be able to define ionization energy and electron affinity.

30. The student will be able to understand the basic concepts of chemical bonding including electronegativity, valence electrons and electrostatic forces.

31. The student will be able to define ionic and covalent bonds and distinguish between ionic and covalent (molecular) compounds.

32. The student will learn the concept of resonance.

33. The student will be able to understand the concept of bond dipoles and determine polarity of molecules.

34. The student will learn how to predict molecular geometry using valence shell electron-pair repulsion theory (VSEPR).

35. The student will be able to distinguish between sigma and pi bonds.

36. The student will be able to understand the concept of orbital hybridization.

37. The student will be able to understand molecular orbital theory, including bonding and antibonding orbitals.
38. The student will learn the basic properties of liquids and solids.
39. The student will be able to differentiate between intramolecular and intermolecular forces.
40. The student will learn the difference between hydrogen bonds, dipole-dipole forces, ion-dipole forces and dispersion forces.
41. The student will be able to understand phase changes and phase diagrams.
42. The student will learn the basics of crystal structure.
43. The student will learn the properties of solutions, including solution terminology and electrolyte behavior.
44. The student will learn how to use the dilution equation ($M_iV_i = M_fV_f$) to prepare various solutions.
45. The student will be able to define colligative properties.
46. The student will learn how to calculate freezing point depression and boiling point elevation.
47. The student will be able to define the term colloid and understand the different types of colloids.
48. The student will be able to understand the concept of real vs. ideal solutions and Raoult's Law.

Course Outline: CHE*K121- General Chemistry I

UNIT 1

I. Chemistry and Matter
    A. Scientific Method
    B. States of Matter
        1. solid
        2. liquid
        3. gas
    C. Pure Substances
        1. elements
        2. compounds
    D. Mixtures
        1. homogeneous mixtures
        2. heterogeneous mixtures
    E. Physical and Chemical Properties
    F. Metric System
        1. Basic SI Units of Measurement
            a. mass
            b. volume
            c. length
        2. SI prefixes
            a. tera-
            b. giga-
            c. mega-
            d. kilo-
            e. deci-
            f. centi-
            g. milli-
            h. micro-
            i. nano-
            j. pico-
        3. Temperature Scales
            a. Fahrenheit
            b. Celsius
            c. Kelvin
    G. Dimensional Analysis and Significant Figures
        1. conversion factors
        2. temperature conversions
II. Atoms, Ions and Molecules
    A. Atomic Theory
        1. subatomic particles
            a. protons
            b. neutrons

        c. electrons
    2. radioactivity
    3. isotopes
    4. atomic number
    5. mass number
B. Periodic Table
    1. periods
    2. groups or families
        a. alkali metals
        b. alkaline earth metals
        c. halogens
        d. noble gases
        e. transition metals
    3. metals
    4. nonmetals
    5. metalloids
C. Chemical Symbols and Formulas
    1. elements
    2. molecules
    3. ions
        a. monatomic ions
        b. polyatomic ions
D. Chemical Nomenclature
    1. naming ionic compounds
    2. naming covalent compounds
    3. naming acids and bases

III. Mass Relationships in Chemical Reactions
A. Atomic Mass
B. Molar Mass
C. Avogadro's Number and the Mole
D. Percent Composition
E. Empirical Formula and Molecular Formula
    1. Determination of molecular formula from empirical formula and molecular weight
F. Chemical Equations
    1. reactants
    2. products
    3. symbols
        a. states of matter
        b. arrows
        c. delta sign
    4. coefficients
    5. balancing chemical equations
G. Stoichiometry
    1. limiting reagent calculation
    2. calculation of theoretical yield
    3. calculation of percent yield

UNIT 2

I. Chemical Reactions
    A. Types of Reactions
        1. synthesis
        2. decomposition
        3. displacement
        4. metathesis
        5. combustion
    B. Reactions in Aqueous Solution
        1. acid-base reactions
            a. acid-base titrations
        2. oxidation-reduction reactions
            a. redox titrations
II. Concentration of Solutions
    A. molarity
    B. % by mass
    C. % by volume
    D. normality
III. Gravimetric Analysis
IV. Gases
    A. Pressure Units
        1. pascal
        2. torr
        3. atm
        4. psi
        5. bar
    B. Properties of Gases
    C. Kinetic Molecular Theory
    D. Gas Laws
        1. Boyle's law
        2. Charles's law
        3. combined gas law
        4. Avogadro's law
        5. ideal gas equation PV = nRT
            a. deviations from ideal behavior
        6. Dalton's law of partial pressures
    E. Molar Gas Volume
    F. Gas Density
    G. Gas Constant (R)
    H. STP- standard temperature and pressure
V. Acids and Bases
    A. Properties of Acids and Bases
    B. Bronsted acids and bases

1. conjugate acid-base pairs

C. Acid-Base properties of Water
1. pH

D. Strengths of Acids and Bases
1. monoprotic, diprotic, polyprotic acids

E. Organic Acids and Bases
1. carboxylic acids
2. amines

F. Lewis Acids and Bases

I. Energy

A. Types of Energy
1. radiant energy
2. thermal energy
3. chemical energy
4. kinetic energy
5. potential energy

B. Energy Changes in Chemical Reactions
1. endothermic reactions
2. exothermic reactions
3. state functions
4. first law of thermodynamics
5. work and heat

C. Enthalpy
1. thermochemical equations
2. standard enthalpy of formation
3. standard enthapy of reaction
4. Hess's law
5. heat of solution
6. heat of dilution

D. Calorimetry

UNIT 3

II. Electronic Structure of Atoms

A. Quantum Theory
1. Planck's quantum theory
2. properties of waves
    a. wavelength
    b. frequency
    c. amplitude
3. Electromagnetic Radiation

B. Photoelectric Effect

C. Bohr's Model of the Hydrogen Atom
1. emission and line spectra
    a. Lyman series
    b. Balmer series

c. Paschen series
d. Brackett series

D. Dual Nature of the Electron
1. DeBroglie equation

E. Quantum Mechanics
1. Heisenberg uncertainty principle
2. Schrodinger equation and quantum numbers
a. principle quantum number (n)
b. angular momentum quantum number (l)
c. magnetic quantum number (m_l)
d. electron spin quantum number (m_s)
3. atomic orbitals
a. s-orbitals
b. p-orbitals
c. d-orbitals
d. f-orbitals

F. Electron Configurations
1. Pauli exclusion principle
2. diamagnetism and paramagnetism
3. Hund's rule
4. Aufbau principle

III. Periodic Properties of the Elements

A. Development of the Periodic Table
1. Newlands
2. Mendeleev

B. Atomic Radius

C. Ionization Energy

D. Electron Affinity

I. Chemical Bonding I

A. Lewis Symbols

B. Ionic Bonds
1. electronegativity and the periodic table
2. lattice energy

C. Covalent Bonds
1. polar covalent
2. nonpolar covalent

D. Lewis Structures
1. multiple bonds
2. resonance structures
3. formal charge assignment
4. the octet rule
5. exceptions to to octet rule

II. Chemical Bonding II

A. Molecular Geometry and Polarity of Molecules
1. dipole moment
2. valence shell electron-pair repulsion theory

a. linear
b. bent
c. trigonal planar
d. trigonal pyramid
e. trigonal bipyramid
f. tetradedral
g. octahedral
h. square planar

B. Valence Bond Theory
1. orbital hybridization
a. sigma bonds
b. pi bonds

C. Molecular Orbital Theory
1. bonding orbitals
2. antibonding orbitals

UNIT 4

III. Liquids and Solids
A. Properties of Liquids and Solids
1. viscosity
2. surface tension
3. density

B. Intermolecular vs. Intramolecular Forces
1. van der Waals forces
a. dipole-dipole forces
b. dispersion forces
c. dipole-induced dipole forces
d. hydrogen bonds
2. ion-induced dipoles

C. Crystal structure
1. unit cell
2. packing spheres
3. x-ray crystallography
a. Bragg equation
4. ionic crystals
5. covalent crystals
6. molecular crystals
7. metallic crystalls

D. Amorphous Solids

E. Phase Changes
1. vapor pressure
2. evaporation
3. molar heat of vaporization
a. Clausius-Clapeyron equation
4. condensation

5. boiling point
6. critical temperature
7. critical pressure
8. melting point and freezing point
9. molar heat of fusion
10. sublimation
11. deposition

F. Phase Diagrams
1. triple point
2. supercritical fluids

IV. Physical Properties of Solutions

A. Types of Solutions
1. saturated
2. unsaturated
3. supersaturated

B. Concentration Units
1. percent by mass
2. mole fraction
3. molarity
4. molality
5. normality
6. percent by volume

C. Solubility
1. factors affecting solubility
2. fractional crystallization
3. gas solubility
    a. effect of pressure on gas solubility; Henry's law.

D. Colligative Properties
1. vapor pressure lowering
    a. Raoult's law
2. fractional distillation
3. boiling point elevation
4. freezing point depression
    a. determination of molecular weight by freezing point depression
5. osmotic pressure
6. colligative properties of electrolyte solutions

E. Colloids
1. aerosols
2. foams
3. emulsions
4. sols
5. gels
6. hydrophilic and hydrophobic colloids; soaps

CHE*K121 General Chemistry I- Tentative Academic Schedule Fall 2010
30091 Lecture: TR 1:00-2:25 p.m. D212
30094 Lab: R 8:00-11:00 a.m. B216

WEEK 1
R- 8/26 *LAB: Orientation, Lab Safety and Procedures*. *Discussion of Course*.

WEEK 2
T- 8/31 Ch 1- Chemistry, Matter and Measurements /Ch 2- Atoms, Ions and Molecules
R- 9/02 *LAB: experiment #1 Density.*

WEEK 3
T- 9/07 Ch 2 cont'd/./Ch 3- Mass Relationships in Chemical Reactions.
R- 9/09 *LAB: experiment #6 Formula of a Hydrate.*

WEEK 4
T- 9/14 Ch 3 cont'd.
R- 9/16 *LAB: experiment #5 Identification of a Compound by Mass Relationships.*

WEEK 5
T- 9/21 **UNIT TEST 1 (Ch 1-3)**
R- 9/24 *LAB: Acid-Base Titration I (handout)*

WEEK 6
T- 9/28 Ch 4---Reactions in Aqueous Solutions
R- 9/30 *LAB: Acid-Base Titration II (handout)*

WEEK 7
T- 10/05 Ch 4 cont'd. / Ch 5 Gases
R- 10/07 *LAB: Molar Gas Volume (handout)*

WEEK 8
T- 10/12 Ch 5 cont'd /.Ch 6- Thermochemistry.
R- 10/14 *LAB experiment #14 Heat Effects and Calorimetry.*

WEEK 9
T- 10/19 **UNIT TEST 2 (Ch 4, 5, 6)**
R- 10/21 **LAB TEST 1**

WEEK 10
T- 10/26 Ch 7 Electronic Structure of Atoms.
R- 10/28 *LAB: experiment #36 Qualitative Analysis of Group I Cations.*

WEEK 11
T- 11/02 Ch 7 cont'd./ Ch. 8 Periodic Relationships among the elements
R- 11/04 *LAB: experiment #33 Preparation of Copper (I) Chloride.*

WEEK 12
T- 11/09 Ch 8 cont'd./ Ch. 9- Chemical Bonding I
R- 11/11 VETERANS DAY- NO CLASS

WEEK 13
T- 11/16 Ch 9 cont'd//Ch 10- Chemical Bonding II. Problems:
R- 11/18 8 *LAB: experiment #13 Molecular Models.*
1:00 p.m. Ch 10 cont'd.

WEEK 14
T- 11/23 **UNIT TEST 3 (Ch 7, 8, 9, 10)**
R- 11/25 THANKSGIVING HOLIDAY

WEEK 15
T- 11/30 Ch 11- Liquids and Solids
R- 12/02 *LAB: Molecular Weight by Vapor Density (handout)*

WEEK 16
T- 12/07 Ch 12- Physical Properities of Solutions
R- 12/09 *LAB- experiment #19 Molecular Weight by Freezing Point Depression.*

WEEK 17
T- 12/14 **LAB TEST 2** (covers second half experiments)
R-12/16 **FINAL EXAMINATION**