SOUTHERN CONNECTCUT STATE UNIVERSITY
CHE 121 - General Chemistry II
General Syllabus
Lectures: TBA

Name: **Office:** **Phone:** **E-mail:**	**Office Hours:** TBA

COURSE NUMBER CHE 121 **CREDIT HOURS**: 4 **PREREQUISITES:** CHE 120

COURSE TITLE: General Chemistry II

COURSE DESCRIPTION:

Expected Student Learning Activity	Weekly Hours for Course*	Total Hours for Course (14 week semester)	Term Credits Earned
Lecture time (Contact Hours)	3	39	
Reading and Study Time	4	56	
Recitation	1	14	
Laboratory (Contact Hours)	3	42	
Laboratory Reports	3	42	
Examinations		3 (midterms) 2 (Final Exam)	
Total Hours	**14**	**198**	**4**

*** Please note that these times are only estimates based on the Department of Education's definition of a credit hour and do not guarantee a specific grade in the course. Students may find that they require more or less time to succeed in the course.**

Physical properties of gases, liquids, solids and solutions. Study of reaction kinetics and development of rate law expressions. Examination of dynamic equilibrium, acid-base chemistry and buffer solutions. Study of thermochemistry and relationship to equilibrium situations. Practical applications of electrochemistry.

COURSE'S CONTRIBUTION:
CHE 121 is the second course in the general chemistry sequence. The course is a requirement for students pursuing the science education degree in chemistry. The course involves the further study of the fundamental principles of chemistry as they pertain to the understanding of physical and chemical properties of matter.

The course emphasizes analytical thinking and applications to problem solving using both quantitative and qualitative approaches. Students are expected to apply new concepts as well as those discussed in the prerequisite course (CHE 120) to curricular material. A working knowledge of algebra is required and knowledge of basic calculus is strongly suggested.

The qualitative aspects of the course involve the extension of basic atomic theory and application to the properties

of matter that can be measured and assessed in every day life. Quantitative aspects of the course address the use and manipulation of established mathematical data and equations. Application of these equations requires an understanding of the underlying theories and the limitations that may be imposed by using such approaches. Both qualitative and quantitative approaches are used to develop critical thinking skills that can be extended to a wide variety of real life situations in an educational setting.

The laboratory experiments and problem sets are designed to place an emphasis on the key learning goals of the course. Laboratory conduct and practices are outlined and encompass an inquiry-based approach to learning, environmental concerns, safety in science instruction and methods for the creation of an appropriate learning environment. Experiments involve gathering and manipulating empirical data and relating outcomes to the theories discussed in lecture as well as assessing any limitations of the experimental approach.

LEARNER OUTCOMES & ASSESSMENT

1. Identify the intermolecular and intramolecular forces existing between molecules of a pure substance and relate these to the observed differences in physical properties. Students will learn to identify whether a molecule is polar or non-polar, and then characterize the forces of attraction between them. They will then be expected to predict the strengths of boiling points, melting points, etc., based on these forces of attraction. (INTASC 1, 4; NSTA 1, 3, 4, 7)

2. Identify the effect of pressure and temperature on the physical states of matter with the use of phase diagrams and correlation to properties such as vapor pressure. Students will be able to explain and interpret phase diagrams and predict the state of matter at a certain temperature and pressure and identify key aspects of the diagram such as triple points, and critical temperature or pressure.. (INTASC 1, 4; NSTA 1, 2, 3, 4)

3. Understand the basic types of structure and bonding of matter in the solid state. Students will learn the various forms of solids and why there is a greater variety of bonding in solids than the other two states of matter. (INTASC 1, 4; NSTA 1, 2, 3, 4)

4. Use the close packing model of structures in the solid state to calculate properties such as the density of solids, bond distances in solids, number of molecules in the unit cell and the percent of empty space. Students will be assigned problems that allow them to calculate the various properties listed above and will be expected to perform mathematical calculations applying related trigonometric relationships. (INTASC 1, 4; NSTA 1, 2, 3)

5. Understand the solution process and correlation to thermodynamic properties based on intermolecular and intramolecular forces. Students will be able to differentiate among solute-solute forces, solvent-solvent forces, and be expected to predict whether a solution will be expected to be formed between any two substances. (INTASC 1, 4; NSTA 1, 2, 3, 4)

6. Perform calculations and conversions based on different concentration units for solutions. Students will be given assigned problems and be expected to answer questions on quizzes and exams relating the various concentration units through mathematical manipulations. (INTASC 1, 4; NSTA 1, 2, 3, 4)

7. Identify the factors affecting solubility of substrates in solution and calculations based on limits of a saturated system. Students will be expected to discuss in short essays on examinations how temperature, pressure and intermolecular forces of attraction affect the solution process. (INTASC 1, 4; NSTA 1, 2, 3, 4)

8. Identify types of colligative properties of solutions and perform calculations based on boiling point elevation, freezing point depression and vapor pressure lowering. Students will perform a laboratory experiment to learn how adding a substance to a liquid affects the properties of the liquid, and how to calculate the molecular mass of the substance from that information. (INTASC 1, 4; NSTA 1, 2, 3, 4, 7)

9. Develop expressions for reaction rates based on tables of kinetic data. Students will be expected to answer questions on homework and examinations, in addition to performing a laboratory experiment, which will allow them to make these calculations from tabulated experimental data and critical evaluation of the trends. (INTASC 1, 4; NSTA 1, 2, 3, 4)

10. Correlate the effect of solution concentration and temperature on the rate of reactions. Students will carry out a laboratory experiment in which they measure the rate of a chemical reaction with varying concentrations of reactants. (INTASC 1, 4; NSTA 1, 2, 3, 4)

11. Postulate reaction mechanisms based on kinetic data and identify the effects of catalysis from a thermodynamic perspective. Students will be expected to apply the rate-determining step approximation to a reaction mechanism to explain the observed experimental rate law. Students will be expected to explain the effect of a catalyst on a reaction mechanism by relating it to the Arrhenius activation energy. (INTASC 1; NSTA 1, 2, 3, 4, 7, 10)

12. Understand the general concepts of solution equilibrium and the calculation of equilibrium constants. Students will be expected to write the equilibrium expression of a chemical reaction by inspection. They will be able to differentiate this process from that of determining a rate law for a reaction. (INTASC 1, 4; NSTA 1, 2, 3, 4, 7)

13. Use LeChâtlier's principle to qualitatively and quantitatively demonstrate the effect of perturbations to a solution in equilibrium. Students will be able to predict in which direction an equilibrium will shift, upon addition of a reactant or product, changing the pressure or volume, changing the temperature or adding a catalyst. (INTASC 1, 4; NSTA 1, 2, 3, 4, 7)

14. Relate the concept of equilibrium to solutions of weak acids and bases and calculations of pH, pK_a and pK_b. Students will learn the concept of pH, how to write equilibrium expressions for weak acids and weak bases, and how to solve those expressions for the concentration of hydrogen ions and hydroxide ions. Students will also demonstrate application of the theories to laboratory exercises and physical measurement of quantities such as pH. (INTASC 1, 4; NSTA 1, 2, 3, 4)

15. Understand the common ion effect and the relationship to buffer solutions. Students will be expected to predict the effect of adding a substance in common with one of the reactants or products on the direction of equilibrium and how adding a common ion creates a buffered solution. Students will demonstrate the concepts through qualitative and quantitative interpretation on assigned problems, quizzes, exams and for laboratory experiments. (INTASC 1, 4; NSTA 1, 2, 3, 4)

16. Calculate the pH of buffer solutions and intermediate solutions in the titration of acids and bases. Students will learn the Henderson-Hasselbach equation and be able to perform mathematical calculations to solve for concentrations or pH of buffered solutions. (INTASC 1, 4; NSTA 1, 2, 3, 4)

17. Apply the concept of equilibrium to solution solubility and the precipitation and separation of ions for qualitative analysis of unknown solutions. Students will perform laboratory experiments to determine the solubility product constant for a slightly soluble salt and, also, be expected to use the concepts of solution solubility to determine the components of an unknown mixture. Students will be able to perform mathematical calculations to determine limits of solubility for a given compound and selective precipitation of compounds in a mixture. (INTASC 1, 4; NSTA 1, 2, 3, 4)

18. Apply the equilibrium concept to spontaneous processes and correlation with thermodynamic quantities. Students will be able to relate the concepts of equilibrium previously learned to the ideas of thermodynamics, and be expected to know how to predict whether or not a chemical reaction is spontaneous on a qualitative and quantitative basis. (INTASC 1, 4; NSTA 1, 2, 3, 4)

19. Understand the concepts related to the operation of voltaic cells and calculations of cell electromotive force. Students will learn the Nernst equation and be able to manipulate it to solve for electromotive force or, given the electromotive force, solve for concentrations of reactants or products. (INTASC 1, 4; NSTA 1, 2, 3, 4, 7)

20. Utilizing the cell potential in voltaic cells to determine the spontaneity of redox reactions. Students will be expected to relate the electromotive force to the equilibrium constant and the thermodynamic criterion for spontaneity, i.e. Gibbs Free energy for problems, quizzes, exams and be able to determine cell potentials, free energy values etc through mathematical calculations. (INTASC 1, 4; NSTA 1, 2, 3, 4)

21. Understand the composition commercial voltaic cells, electrolysis, and corrosion prevention. Students will be expected to differentiate between voltaic cells and electrolytic cells and what the purpose of each is. Students will be expected to perform mathematical calculations for assigned problems, quizzes, exams to determine the specified variable quantity to be determined related to the various equations pertinent to the area of study. Students are expected to memorize the related equations. (INTASC 1, 4; NSTA 1, 2, 3, 4, 7)

22. Understand basic rules for naming organic compounds and identifying structure based on functional group identification. Students will receive an introduction to organic chemistry and be able to identify those parts of the chemical structures that give rise to a substance's functionality. Once recognizing the functional group, the students will be expected to name the molecule accordingly. (INTASC 1, 4; NSTA 1, 2, 4)

23. Relate the chemical concepts learned in class to experimental data obtained in the laboratory. The students will be performing laboratory experiments throughout the semester to demonstrate the actual application of the theoretical concepts they are exposed to in lecture. (INTASC 1, 4; NSTA 1, 2, 3, 4, 5, 6, 7, 9, 10)

MODES OF LEARNING

Class lectures are primarily that, however, the students are expected to participate in problem solving both in lecture and in recitation sections in order to reinforce the concepts. Students are required to complete all laboratory experiments as well as attending recitation sessions and completing all quizzes during recitation. The lab experiments reinforce many of the chemical concepts covered in lecture and students are expected to apply the concepts to the laboratory experiments. Please remember that it is the policy of the Chemistry Department at Southern Connecticut State University that, to receive a passing grade in CHE 121, you **must pass the laboratory portion** of the course. A passing grade for the laboratory portion of the course is 60%.

COURSE CONTENT OUTLINE

	Topic	**Assigned Reading**
Lectures 1-2	Energy and Chemical Change	Ch. 6
Lectures 3-5	Intermolecular Attractions and the Properties of Liquids and Solids	Ch. 11
Lectures 6-8	Properties of Solutions	Ch. 12
Lectures 9-10	Kinetics	Ch. 13
Lecture 11	**Exam #1 Chapters 6, 11 and 12**	
Lectures 12-13	Chemical Equilibrium	Ch. 14
Lectures 14-15	Acids and Bases	Ch. 15
Lectures 15-16, 18	Equilibria in Solutions of Weak Acids and Bases	Ch. 16
Lecture 17	**Exam #2 Chapters 13, 14, 15**	
Lectures 18-20	Solubility and Simultaneous Equilibria	Ch. 17
Lectures 21-25	Thermodynamics	Ch. 18
Lecture 26	**Exam #3 Chapters 16, 17 and 18 (part)**	
Lectures 27-29	Electrochemistry	Ch. 19

Chemistry, *Sixth Edition* N. D. Jespersen, J. E. Brady and A. Hyslop, Wiley (2011)
Laboratory Manual, Catalyst *SCSU Chemistry 121- General Chemistry II*, Pearson Custom Publishing (2005) (ISBN 0-536-71101-1)
Available at SCSU Bookstore bundled.

COURSE REQUIREMENTS

Students will be expected to read the appropriate sections of the text prior to classroom lectures. Students are also expected to attempt sample problems found at the end of each chapter in order to prepare for quizzes and tests. The problems assigned for the recitation session by the professor each week are typical of the content and level of difficulty that can be expected on examinations for the course. These are to be attempted prior to the recitation session to ensure regular student progress.

There will be three term tests of which the lowest grade will be dropped. A series of problem sets and in class quizzes will be given during the term. The best ten grades will be counted. The final examination is cumulative and the date and time will be announced in class.

Students are required to complete ten laboratory exercises in addition to completing the initial safety training and check-in/check-out procedures. Any student who has not completed the safety training will not be permitted to participate in the laboratory exercises. It is the policy of the Chemistry Department at Southern Connecticut State University that, to receive a passing grade for CHE 121, you must receive a passing grade for the laboratory portion of the course. A passing grade for the laboratory portion of the course is 60%. The individual laboratory instructor for the section you have registered in will distribute the evaluation criteria for the laboratory portion of the course.

EVALUATION CRITERIA

Best 2 of 3 Term Examinations	30%
Quizzes	15%
Laboratory Grade	30%
Final Examination	25%

	100%

STANDARDS GUIDELINES

INTASC [Interstate New Teachers' Assessment & Support Consortium]

Scholarship

1. Knowledge of subject matter
2. Knowledge of human development & learning
3. Instruction adapted to meet diverse learners
4. Use of multiple instructional strategies & resources

Attitudes and Disposition

5. Effective learning environment created
6. Effective communication
7. Lesson planning

Professional Standards

National Science Teacher's Association

1. Content - Structure and interpret the concepts, ideas and relationships in science

2. Nature of Science - Define the values, beliefs and assumptions inherent to the creation of scientific knowledge within the scientific community

3. Inquiry - Formulating solvable problems, constructing knowledge from data, exchanging information for seeking solutions, developing relationships from empirical data

4. Context of Science - Relate science to daily life: technological, personal, social and cultural values.

5. Skills of Teaching - Science teaching actions, strategies and methodologies, interaction with students, effective organization and use of technology.

Integrity 9. Reflection and professional development **Leadership** 8. Assessment of student learning to improve teaching **Service** 10. Partnership with school and community	6. Curriculum - Extended framework of goals, plans, materials and resources for instruction. 7. Social Context - Social and community support network, relationship of science to needs and values of the community, involvement of people in the teaching of science. 8. Assessment - Alignment of goals, instruction and outcomes, evaluation of student learning. 9. Environment for Learning - Physical spaces for learning, psychological and social environment, safety in science instruction. 10. Professional Practice - Knowledge and participation in the professional community, ethical behavior, high quality of science instruction, working with new colleagues as they enter the profession.

TENTATIVE COURSE CALENDAR
See "Course Content Outline" above.

DISABILITY ACCOMMODATION STATEMENT
If any student has a particular disability-related need in order to participate in this course they should contact the Disability Resources Office (DRO) as soon as possible to obtain the appropriate documentation. Every effort will be made to accommodate students in this course. The DRO is located at EN C105 or at 203-392-6828.

ADDITIONAL COMMENTS
The *sample problems* distributed by the professor (available on VISTA website) are similar to those found at the end of each chapter in your textbook and are representative of the material in that chapter which the professor feels is the most important for the student to understand. These problems should be attempted in addition to those found throughout the chapter and are representative of typical types of questions and problems that will appear on examinations. (The study of chemistry in this course will examine both qualitative and quantitative aspects and students will be expected to demonstrate strong basic mathematical skills. Problem solving will help strengthen and develop these skills!) Similar problems will be selected on the WileyPlus site that can be accessed using the passkey found in the bundled text/lab manual.

Late/Missed Work: There will be no make-up examinations or laboratory sessions except in the case of substantiated illness (a doctor's note is required). Late lab reports will be given a grade of zero. Late laboratory reports will not be accepted for grading unless accompanied by a doctor's note.

Attendance: Regular and prompt attendance of scheduled classes and laboratory sessions is necessary for the student to derive the intended benefit of the learning experience the college strives to provide, and for the optimization of student academic progress.

Laboratory: The first laboratory session will be held on **TBA.** The chemistry department requires that everyone wear Safety Glasses while in the laboratory, beginning with the first laboratory. The proper safety glasses must meet OSHA regulations and can be purchased at the Southern Connecticut State University Bookstore. Ask specifically

for the Safety Glasses for General Chemistry Laboratory. If you show up for any laboratory period without the proper safety glasses or attire you will **NOT** be allowed to perform the experiment and will receive a zero grade for that experiment. Additional information regarding the laboratory portion will be provided in the laboratory syllabus.

Students who are pregnant should not enroll in this course due to the nature of the chemicals used in the laboratory.

Inclement Weather: When inclement weather threatens, call the university's WeatherChek voice mail message line (203-392-SNOW) to hear the latest official information on possible delayed openings, class cancellations, or the closing of the university. In the event that an examination is postponed due to weather, the examination will be scheduled for the next class meeting.

Additional Thoughts: The student should read the appropriate text sections prior to attending class since lectures will cover the material at a reasonably rapid pace. The student will be expected to adapt to this pace. Attempting related problems prior to class is also strongly suggested. If you encounter difficulties when problem solving it often helps to return to the pertinent section in the text and review the material and sample problems. If you are still encountering difficulty with a particular problem don't get frustrated or spend excessive time on that problem. Please come talk to the professor and we can review the problem(s) together. Alternatively you can use the online resources for that accompany the text to test your problem solving skills.

Your grade will not be based upon any claimed "need" which you may have. If you "need" a B in this course in order to gain admission into some program or transfer the course credit, then it is incumbent upon you, the student, to perform at the level that will fulfill the specific "need." It is not the professor's role to alter his or her evaluations of your work so as to take your "needs" into account.

There is no provision in this course to do work for "extra credit." It stands to reason that if a person is not performing adequately in the assigned tasks of a course, there is no point in giving that person "extra" work. Requests to do work for "extra credit" will not be honored.

Additional Resources:
The following sites contain tutorial materials and practice problems.
http://misterguch.brinkster.net/chemfiestanew.html
http://science.widener.edu/svb/tutorial

Missed/Late Work:
Assignments and laboratory reports are due at the beginning of the scheduled meeting time. Late or missed tests, assignments, and quizzes will receive a grade of zero except in the case of substantiated illness (a doctor's note is required). A student must inform the instructor prior to the evaluated exercise in order to receive consideration. Laboratory reports will be deducted 10% per day (excluding weekends and holidays) if they are not submitted at the scheduled time up to a maximum of 7 days at which time a grade of zero will be assigned. There is no extra credit nor make-up examinations given that the lowest test grade and at least three of the lowest assignment/quiz grades will be dropped. Failure to complete more than one laboratory exercise will result in a grade of zero for the course. Missed laboratory exercises may be completed at another session, during the same scheduled week of class, only if granted permission by the course instructor. In this case, a signed permission slip must be obtained from the instructor in order to gain entry into a different section of laboratory.

Inclement Weather:
Official information regarding class cancellations or delays can be obtained from the university WeatherChek voice mail system at 203-392-SNOW. If a scheduled examination, quiz or assignment is postponed due to weather it is assumed that the exercise will be rescheduled to the next available classroom session.

Attendance:
Regular and prompt attendance of scheduled classes is not mandatory but is strongly recommended to achieve success in this course. Prompt attendance for laboratory sessions is required. Students arriving late to laboratory sessions will not be able to participate in the preliminary discussion and will not be allowed to complete the exercise.

Cell Phones:
All cell phones and pagers must be turned off during lecture and laboratory. Students who ignore this policy will be

asked to leave the classroom or laboratory and will receive a grade of zero for all evaluations to be carried out during that time. If you are on call for work related emergencies or personal reasons please switch all devices to a mode that will not disturb the class (i.e. vibrate mode) and inform the instructor prior to class.

Academic Dishonesty:
Cheating on exams, laboratory reports, quizzes, and assignments will not be tolerated in this class. All students are expected to behave according to the code of conduct outlined in the student handbook. Apparel such as baseball caps that conceal your eyes during examinations will not be permitted. Programmable calculators will not be permitted unless you make prior arrangements with the instructor to demonstrate that all memory functions are free of equations or other information. Strict disciplinary action will be taken if these rules are not followed!