Summer 2016

Principles of Chemistry I (Savannah State University)

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Grants Collection
Savannah State University

UNIVERSITY SYSTEM OF GEORGIA

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Principles of Chemistry I

Affordable Learning Georgia

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Grants Collection

Affordable Learning Georgia Grants Collections are intended to provide faculty with the frameworks to quickly implement or revise the same materials as a Textbook Transformation Grants team, along with the aims and lessons learned from project teams during the implementation process.

Each collection contains the following materials:

- Linked Syllabus
  - The syllabus should provide the framework for both direct implementation of the grant team's selected and created materials and the adaptation/transformation of these materials.
- Initial Proposal
  - The initial proposal describes the grant project's aims in detail.
- Final Report
  - The final report describes the outcomes of the project and any lessons learned.

Syllabus

Savannah State University
College of Science & Technology

CHEM 1211-04 **PRINCIPLES OF CHEMISTRY I**
Fall Semester 2016

Instructor & Title: Cecil Jones, Ph.D., Professor of Chemistry
Office Location: Drew Griffith-222
Office Hours: Office hours are tabulated on the last page.
Telephone: 912-358-4453
E-Mail: jonesce@savannahstate.edu
Course Credit Hours: 3
Class Location: Drew Griffith-233
Class Time: Mon., Wed. & Fri.; 1:00 – 1:50 PM

COURSE DESCRIPTION: This is the first course in a two-semester sequence covering the fundamental principles and applications of chemistry for science majors. Topics to be covered include composition of matter, nomenclature, stoichiometry, periodic relationships, atomic structure and bonding, chemical reactions and thermochemistry.

PREREQUISITES: Chemistry Placement Test or successful completion of CHEM 1115 (grade "C" or better).

STUDENT LEARNING OUTCOMES:

1. Students should demonstrate a fundamental understanding of the composition and structure of matter, as well as the changes that matter undergoes in the process of a chemical reaction.
2. Students are expected to recognized common chemical species by systematic nomenclature.
3. Students should understand universal laws and the basic theories governing physical and chemical changes in matter.

COURSE OBJECTIVES:

A. To introduce the students to the very basic structure of matter which constitutes the whole universe and to give them a fundamental knowledge about the laws and guiding principles of chemistry as experienced in all parts of our everyday life.
B. To train them in the basic aspects of chemical structure and to enable them to think in terms of chemistry
C. To make them proficient in the use of chemical nomenclature and language including chemical reactions, and the laws governing these reactions.
D. To inculcate/instill the knowledge about the historical development of the basic chemical principles including the modern aspects. Effort will be made to impart to the students the scientific truth that the field of Chemistry touches all parts of our lives because of its broadness in scope. They also will gradually learn that there is

no getting away from chemistry, since a basic knowledge of chemistry is highly essential to learn any other scientific discipline!

REQUIRED TEXTS AND MATERIALS:
OpenStax Chemistry text will be used for this course. Use Google (not explorer) to visit the OpenStax College website: https://openstax.org/details/chemistry. You may download a pdf version of the text. There are also options for a print and/or iBook copy. Other open educational materials will be provided during the course.

PEDAGOGICAL APPROACH:
Class Attendance Policy: All students are required to attend class on time! Late arrivals disrupt class activities. Any student who is late by more than five minutes will not be admitted in class. This will represent an absence. According to the Savannah State University Attendance Policy, credit may not be awarded for any course if the number of absences exceeds **"%15 of class hours."** Students who live **off campus** and have special circumstances that may cause late arrivals should consult with me immediately.

Academic Honesty: We recommend that you use the exact text from the current catalog regarding the Savannah State University Academic Honesty Policy.

Methods of Instruction: Lecture and discussion are the primary means of instructing students in this course. Examples involving basic chemistry applied toward biological and environmental analysis will be discussed. Students are strongly encouraged to actively engage the instructor and their peers regarding concepts of chemistry. .

Examinations: There will be a total of 4 classroom examinations each lasting no more than 1 hour. Theses exams will be averaged to represent 50% of your course final grade. If time permits, there may be a 5^{th} exam included in the 50% of your final grade. The assigned homework will account for 20% of your grade. The remaining 30% of your grade will be determined by your score on the American Chemical Society (ACS) General Chemistry I Final Examination. The computation of your final grade is shown in the "**Grade Determination**" section. Students will be permitted to see the results of their examinations. However, they will remain with the instructor for record.

SSU's QEP: In support of the Savannah State University's Quality Enhancement Plan, "The Write Attitude," and the outcomes of this course, students will produce a minimum of **4** pages of writing during the semester in a variety of forms. A total of 4 points are possible (1/exercise, all or nothing). Active participation in the writing exercises may improve your final grade in the course. The student will be granted 1 point only if a serious effort to complete the assignment has been demonstrated (4 points possible).

Several impromptu (pop) quizzes may be given, usually during the first ten minutes of the class. Quizzes are provided to prepare the student for the classroom examinations. They will not be used for a grade determination. NO MAKE-UP IMPROMPTU QUIZZES WILL BE GIVEN.

The instructor of record reserves the right to modify this syllabus and course requirements as needed.

Homework: Suggested problems from the textbook are provided for practice and preparation for classroom examinations. Each **completed chapter** is worth 1 point (all or nothing) for a total of 10 points. Students are strongly encouraged to prepare for the learning experience of each lecture by reading ahead.

GRADE DETERMINATION:

Four or five classroom examinations will be averaged to represent 50% of your final grade and homework 20%. The remaining 30% of your grade will be determined by your score on the American Chemical Society (ACS) General Chemistry I Final Examination. QEP assignments can significantly increase your final score.

Computation for the Letter Grade

1. Four classroom examinations..... 50%
2. Homework assignments……...20%
3. *X* = Points from QEP writing assignments
4. ACS Final Examination..... 30%

$$\frac{\sum_{i=1}^{n} Exam_i}{n} \times 50\% + \frac{\sum_{i=1}^{n} Homework_i}{n} \times 20\% + X_{writing\ points} + ACS\ Final\ Exam \times 30\% = Total\ Numerical\ Grade$$

where *n* = the total number of classroom examinations (4 or 5) and *x* = the 4 possible points for completed QEP writing assignments.

Students' letter grade will be assigned based on the calculation above and the scale below:

Total Numerical Grade	Letter Grade
90% and above	A
80-89	B
70-79	C
60-69	D
Below 60	F

REQUIRED DISIBILITY Statement

Savannah State University is committed to providing reasonable accommodations to students with documented disabilities, as required under federal law. The purpose of disability accommodation is to provide equal access to the academic material and equal access to demonstrate mastery of the material. Students with disabilities must meet all the academic requirements and standards of the class, including the attendance policy. If you have a disability and need accommodations, please contact Amelia Castilian-Moore, Coordinator of Disability Services at 912 358 3115 or moorea@savannahstate.edu. The Office of Counseling and Disability Services is located in King Frazier 233. You will need to meet with Ms. Castilian-Moore, who can help you gather documentation of your disability or refer you to an appropriate resource for assessment. Once documentation of the disability is gathered and approved, Ms. Castilian-Moore will provide you with an Accommodation Letter, detailing the appropriate, approved accommodations, which you should present to me so we can discuss and implement your accommodations.

The instructor of record reserves the right to modify this syllabus and course requirements as needed.

COURSE OUTLINE AND READING ASSIGNMENTS

The following outline and readings may change as the course progresses, as the instructor deems necessary given student interests and needs. You are to read the assignments prior to the date in the course outline, present a thoughtful question to enhance dialogue, and be prepared to offer salient points to class discussion.

Tentative Course Schedule & Exam Dates:

Unit I. Chapters 1 & 2: Essential Ideas & Atoms, Molecules and Ions

Chapter 1
Chapter 2

Objectives:

1. Think like a chemist.
2. Know the basic metric units and the prefixes used to indicate multiples and sub multiples of the basic units.
3. Explain the difference between the mass and weight of an object.
4. Set up and work unit system conversion problems using dimensional analysis.
5. Distinguish between density ad specific gravity, including the unit of each
6. Calculate the density of a substance, given its mass and volume and use density as conversion factor between mass and volume or vice versa.
7. Know and be able to the interrelationship between Fahrenheit, Celsius and Kelvin temperature scales
8. Know and explain the Atomic Theory
9. Know the structure of an atom
10. Know what atomic number, mass number and isotopes are
11. Know the periodic table of elements.
12. Know the difference between molecules and atoms, and how ions are formed from atoms.
13. Know chemical formulas and know are compounds are named.

August 29 ⇨ Exam #1 over chapters 1 & 2.

Unit II, Chapters 3 & 4: Compositions of Substances and Solutions & Stoichiometry

Chapter 3
Chapter 4

Objectives:

1. Define and distinguish between atomic mass and molecular mass, gram-atom and gram-mole.
2. Determine the mass of reactants required for a reaction
3. Determine the precise amount of reactant(s) necessary to yield a desired amount of product
4. Determine the concentration of solution in terms of molarity molality and mass percent
5. To learn about occurrence of isotopes of elements and to know the method of calculating the average atomic weight; calculate % weight, empirical and molecular formulas
6. To know about the use of mass spectrometers and method of determining the atomic mass units: mass spectra

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7. To know about moles and molecular weights and calculations involved with these terms
8. To know how to make solutions of definite molarity; know how to dilute a solution of known concentration to give n molar value
9. Know all the various types of chemical reactions; learn to give representative examples for each type of reaction and know how to balance such reactions; know how to calculate the weight of reactants to obtain known weight of product
10. Know how to calculate weight of substance from molarity and molarity from known weight
11. Learn how to calculate and identify the limiting reactant, if the weights of reactants are given.

September 26 ⇨ Exam #2 over chapters 3 & 4.

Unit III. Chapter 9: Gases

Chapter 9

Objectives:

1. State and explain each law discussed in this unit
2. Discuss briefly the gas laws and equations studied in this unit and learn how to do problems using the gas equation
3. Define ideal gas law and to know how to use the gas equation; to calculate the molecular weight or number of moles of a substance
4. Work out problems dealing with the concepts studied in this chapter.

Unit IV. Chapter 5: Thermochemistry

Chapter 5

Objectives:

1. Know the basic concepts about enthalpy and its units; know the measurement of heat by calorimetry
2. Understand the terms standard heat of formation of a substance, standard enthalpy (heat) of a chemical reaction, and the calculation of enthalpy from standard tables
3. Learn Hess's Law of heat summation and workout problems using this law, to calculate enthalpies of reactions
4. Know how to measure heat of a reaction by calorimetry.

October 19 ⇨ Exam #3 over chapters 5 & 9.

Unit V. Chapters 6 & 7 partial. Electronic Structure, Chemical Bonding & Molecular Geometry

Chapter 6
Chapter 7

Objectives:

1. Know the nature of a wave and explain the terms such as wavelength, frequency and amplitude as they relate to wave.
2. Know the characteristics of electromagnetic waves/radiations and how they are related.
3. Know Aufbau principle and its application in writing correct electron configurations
4. Distinguish between ground state and excited state electronic configurations
5. Know what the quantum numbers are and their significance
6. Know the difference between paramagnetic and diamagnetic species
7. Calculate the energy of a photon with a given wavelength
8. Know the periodic classification of the elements
9. Arrange species (atoms, cations and anions) in order of increasing or decreasing size/radius
10. Know the variation and general trends in chemical properties of the elements

The instructor of record reserves the right to modify this syllabus and course requirements as needed.

Unit VI: Chapters 7 remaining & 8. Advance Theories of Covalent Bonding

Chapter 7

Chapter 8

1. Identify different types of intramolecular bonds: ionic, covalent and polar covalent.
2. Understand electronic configuration and valence electrons in different atoms; predict valences of atoms and write the formulas, write Lewis structures of compounds as well as ionic species.
3. To learn about increasing electronegativity towards the right of the periodic chart and the fundamental differences between nonmetals and metals; to discuss Pauling's electronegativity chart representing the periodic table and the guidelines of predicting reactivities of elements.
4. Draw Lewis structures of compounds, identify exceptions of the octet rule in certain compounds and explain the electronic suborbital configuration of such cases.
5. Know the Stretching of bond angles and the VSEPR model and to discuss representative molecules and the bond angles.
6. To learn about bond polarity and dipole moments.
7. Explain how the following differ and how they are similar: (a) molecular orbitals and atomic orbitals, (b) bonding and antibonding orbitals, (c) pi orbitals and sigma orbitals.
8. Draw the molecular orbital energy diagrams for heteronuclear and homonuclear diatomic molecules.
9. Determine the bond orders of representative compounds

November 21 ⇨ Exam #4 over chapters 6-8.

Unit VII. Chapter 11: States of Matter and Intermolecular Forces

Chapter 11

Objectives:

1. Learn about the major intermolecular forces prevalent in solids and liquids and their definitive role in predicting the reactivity of the substance
2. Understand the importance of dipole interactions, hydrogen bonding and intermetallic bonds
3. Learn to reason out solubilities of substances
4. Understand crystal lattice and shapes and briefly learn about calculation of interatomic distances in a crystal lattice by using x-rays (X-ray diffraction: Bragg equation); William Henry Bragg and his son William Lawrence Bragg shared the Nobel Prize in 1915 for their pioneering work in X-ray crystallography.

Tentative Examination Schedule

Exams	Chapters	Dates
One	1 & 2	Aug. 29
Two	3 & 4	Sept. 26
Three	5 & 9	Oct. 19
Four	6 - 8	Nov. 21
Final	1 - 11	Dec 4-9

Chemistry 1211 Homework
OpenStax Chemistry, Rice University

Key Homework Problems for Exam Preparation

The instructor of record reserves the right to modify this syllabus and course requirements as needed.

To make an excellent grade on any exam, you must be capable of solving all of the exercises listed below. In addition, no more than 8 seconds should be required to determine a strategy for solving the problems. Keep in mind that the examinations are not given to assess your analytical or problem solving skills; that requires more time for figuring an appropriate strategy. Exams are designed instead to assess your understanding of the chemistry concepts we discussed. Problem solving exercises are provided at the end of each chapter under the heading "Exercises". In addition, improved analytical or problem solving skills are addressed in laboratory exercises.

You must provide the correct answer to the questions below **quickly** to do well on the exams.

Chapter 1

Credit Homework Problem:

- Visit PhET Simulation at the specified web address for Density Determination (http://openstaxcollege.org/l/16phetmasvolden)
- Press the "Mistery" tab on "Blocks" in the top left coner.
- Determine the density of the purple and yellow blocks.

Exercises: Odd problems 1- 99.

Chapter 2

Exercises: 1-33 even and 37-61 even.

Chapter 3

Examples 3.19 – 3.21;
Visit web site: (htpp://openstaxcollege.org/l/16Phetsolvents) and explore the dilution concept.
Exercises 1-80 odd.

Chapter 4

Exercises 1-36 even and 42, 46, 48, 50, 53, 55, 57, 59, 60, 61, 62, 67, 70, 73, 78, 80, 87, 89, 91, 93 and 94.

Chapter 5

Exercises 1-12 odd; 16-21 all; 25, 26, 39, 40, 51, 53, 59, 63, 65, 67, 69 and 85..

Chapter 6

Exercises 1-12 even; 17, 22, 26, 29, 31-38 all, 42, 44, 48, 52, 53, 54, 55, 58, 64, 67-80.

Chapter 7

Exercises 1-26 odd; 28, 30, 32, 38, 39, 40, 45, 47, 51, 52, 60, 64, 65, 74, 77, 80, 83, 87, 91, 93, 95, 97, 101, 106, 112, and 114.

Chapter 8

Exercises 1, 4- 14, 16, 20, 24, 26, 27, 30, 35, 36, 37, 38, 39, 40a, c, and f; 50.

Chapter 9

Exercises 4, 6, 13, 15, 22, 28, 31, 33, 35, 36, 42, 45, 48, 52, 53, 55, 57, 59, 65, 66, 69, 72, 78, 85, 88, 91, 95, 96, 99 and 101.

Chapter 10.

Exercises: 1- 10, 15-19, 23, 25, 26, 28, 30, 32, 35, 36, 37, 40, 41, 42, 43, 45, 46, 47, 48, 51- 60, and 64 – 105 odd.

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Note the dates:

- September 5; (Monday) → Labor Day → No classes and offices are closed.
- **October 4**; (Tuesday) → Midterm Grades Due by 5:00 p.m.
- **October 12**; (Wednesday) ➞ Last day to withdraw without academic penalty.
- October 13 & 14; (Thurs - Fri) → Fall Break → No classes
- November 10; (Thursday) ➞ Founders Day
- November 23-27 (Wed – Fri) → Thanksgiving holidays
- December 1 → (Thursday) Last day of classes
- Final exams will be given Dec 4 – 9.
- December 10 → (Saturday) Commencement in Tiger Arena at 10:00 a.m.

Fall Schedule 2016
Dr. Cecil L. Jones

Monday	Tuesday	Wednesday	Thursday	Friday
Research/Office Hours 9:00 – 11:00 AM		Research/Office Hours 9:00 – 11:00 AM	Research 8:00 – 12:00 AM	Research/Office Hours 9:00 – 11:00 AM
CHEM 1301K - 01 Analytical Chemistry 11:00 – 11:50 AM Drew-Griffith Room 220 4.00 Credit Hrs.	Research 8:00 – 2:00 AM	CHEM 1301K - 01 Analytical Chemistry 11:00 – 11:50 AM Drew-Griffith Room 220 4.00 Credit Hrs.		CHEM 1301K - 01 Analytical Chemistry 11:00 – 11:50 AM Drew-Griffith Room 220 4.00 Credit Hrs.
CHEM 1211-04 Principles of Chemistry 1:00 – 1:50 PM Room 233 3.00 Credit Hrs.		CHEM 1211-04 Principles of Chemistry 1:00 – 1:50 PM Room 233 3.00 Credit Hrs.	Research 1:00 – 5:30 PM	CHEM 1211-04 Principles of Chemistry 1:00 – 1:50 PM Room 233 3.00 Credit Hrs.
CHEM 3602K Chemistry Research 3:00 – 5:50 2.00 Credit Hrs.	CHEM 3101L-01 Analytical Chem. Lab 2:00 – 5:20 Drew-Griffith Room 251 1.00 Credit Hrs	Research/Office Hours 2:00 – 5:00 AM		Research/Office Hours 2:00 – 3:00 PM

If I am absent during office hours, then go to my research lab 232 DG.

The instructor of record reserves the right to modify this syllabus and course requirements as needed.

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Initial Proposal

Affordable Learning Georgia Textbook Transformation Grants
Rounds Three, Four, and Five
For Implementations Beginning Summer Semester 2015
Running Through Spring Semester 2017

Proposal Form and Narrative

- *The proposal form and narrative .docx file is for offline drafting and review. Submitters must use the CompetitionSpace online form for proposal submission.*
- ***Note: The only way to submit the proposal is through the online form in Georgia Tech's CompetitionSpace at:*** ***http://gatech.infoready4.com/CompetitionSpace/#competitionDetail/1738234***
- *If you are copying and pasting into CompetitionSpace from this form, first convert the file to* ***plain text*** *and copy/paste from the plain text file.*
  - *In Word, go to File > Save As… > and change the file format to "Plain Text (.txt)."*
  - *Copy and paste from the .txt file.*
  - *Be sure to save both copies in case you are asked to resubmit.*
- *Microsoft Word Document formatting pasted into CompetitionSpace will render the reviewer copy unreadable.* ***If you paste Word-formatted tables into CompetitionSpace, you may be asked to resubmit your application if time permits.***
- *Italicized text is provided for your assistance; please do not keep the italicized text in your submitted proposal. Proposals that do not follow the instructions may be returned.*

Affordable Textbook Transformation for Principles of Chemistry

Submitter Name	Dr. Cecil L. Jones
Submitter Title	Professor of Chemistry
Submitter Email	jonesce@savannahstate.edu
Submitter Phone Number	912-353-4453
Submitter Campus Role	*Proposal Primary Investigator*
Applicant Name	Dr. Cecil L. Jones
Applicant Email	jonesce@savannahstate.edu

Applicant Phone Number	912-353-4453				
Primary Appointment Title	Professor of Chemistry				
Institution Name(s)	Savannah State University				
Team Members	***(****Name, Title, Department, Institutions if different, and email address for each)*				
Sponsor, Title, Department, Institution	Dr. Hua Zhao, Chair and Professor, Department of Chemistry & Forensic Science				
Proposal Title	Affordable Textbook Transformation for Principles of Chemistry				
Course Names, Course Numbers and Semesters Offered	The proposal is for Principles of Chemistry, CHEM 1211 & 1212. The courses are taught over two semesters and are scheduled throughout the academic year including the fall, spring and summer semesters.				
Final Semester of Instruction	*Select: Fall 2015, Spring 2016**, Summer 2016**, Fall 2016, Spring 2017*				
Average Number of Students Per Course Section	37	**Number of Course Sections Affected by Implementation in Academic Year**	**18**	**Total Number of Students Affected by Implementation in Academic Year**	666
Award Category (pick one)	☐ No-Cost-to-Students Learning Materials ☒ OpenStax Textbooks ☐ Specific Top 50 Lower Division Courses				

List the original course materials for students (including title, whether optional or required, & cost for each item)	Current text materials include the textbook: Chemistry 11th Edition; Reymond Chang and Kenneth A. Goldsby.
Original Per Student Cost	$277.33
Post-Proposal Projected Per Student Cost	0
Projected Per Student Savings	$277.33
Plan for Hosting Materials	☐ OpenStax CNX ☒ D2L ☐ LibGuides ☐ Other _____
Requested Amount of Funding	$10,800.00

1. PROJECT GOALS

An increasing number of students are apparently unable or unwilling to purchase the freshman chemistry textbook. Chemistry concepts are nearly impossible to grasp in the absence of the guides and exercises provided by an accompanying textbook. Consequently, the number of number of students to successfully complete these courses are declining drastically. The key objective of this project is to substantially improve student performance in the freshman chemistry courses, Principles of Chemistry (CHEM 1211 & 1212). The broader impact of this proposal is to improve student retention and ultimately the graduation rates particularly in the STEM disciplines directly impacted by freshman chemistry.

1.1 STATEMENT OF PROBLEM

Required Elements:

A significant percentage of students enrolled in the Principles of Chemistry courses are attending classes without the critical aid of a textbook. Students are consistent in their complaints about the high cost of the required textbook and have decided to try the courses without its purchase. Consequently, an increasing percent of students in these courses are under-performing. This decline in academic performance negatively impacts students' morale and causes them to give up, submitting to underachievement and stagnation in career aspiration.

Many of our students are surviving by meager means even after governmental support and student loans. It would be ideal if there were more affordable ways for students to obtain the materials that would enable them to perform better in these courses. Such materials are becoming increasingly abundant on-line and readily available to students. Investigations show that students rank OERs as #1 on their wish list for instructors' use of technology (1, 2).

The immediate stakeholders include the students, their financial supporters and the university. The textbook problem places a financial burden on students that causes a substantial decrease academic performance and the likelihood of high withdrawal rates. Academic withdrawals in turn leads to decreased retention and lower university graduation rates.

The solution to this problem is for students to have access to a low or no-cost text that can be used in both sections of this course. One of the key benefits for the textbook transition is immediate access to on-line study materials which enable the students to become engaged from the first day of classes (3). Many students fall behind awaiting the arrival of financial aid to purchase textbooks that consumes a significant percent of this aid. Immediate access to on-line texts decreases the probability of student withdrawal from class with the subsequent decline in retention and graduation rates.

1.2 TRANSFORMATION ACTION PLAN

Supportive web materials are currently being incorporated into "Desire-to-Learn, D2L" that will provide assessment data for the chemistry courses as well as the transformation underway. This material include documents associated with the fundamental concepts of chemistry and carefully

selected exercises that reinforce these concepts. An on-line text has been evaluated by our Principles of Chemistry Committee (PCC) and is currently being compared to others for spring 2015 adoption.

Textbook Review & Selection: PCC members are reviewing several textbooks in OER that are licensed to SSU. This review will identify at least 3 potential textbooks for adoption. The committee will consult with the American Chemical Society (ACS) Committee on Professional Training (CPT) to address the suitability of the 3 textbooks. After ACS approval, the faculty team member will meet with all chemistry faculty members to decide on the text favored for adoption in Chemistry 1211 and 1212.

Course Materials: The PI will Chair the PCC, which will focus on assessing the impact of affordable learning. The PCC will meet twice per semester to develop course materials associated with the adopted textbook. Learning outcomes will be assessed. The PI will work with the library to ensure training for chemistry faculty on SSU licensed OERs. All Principles of Chemistry course instructors will meet before any modifications are made following the establishment of course materials.

Instructional Design: A uniform syllabus will be established for all instructors of Principles of Chemistry sections implementing affordable learning materials. The PCC will meet to decide on course content ensuring an optimal foundation in chemistry as required for sustainable success in the higher-level courses. Methods to optimize active participation in the courses will be acquired and implemented to improve students' understanding of challenging concepts. This information will be included in the 1st status report.

Assessment: Instructors will require the completion of 4 course examinations at regular intervals during the semester. This will be arranged by the PCC Chairperson. Students will be informed of their performance and status throughout the semester. Instructors will be required to obtain student evaluations at midterm and at the end of a semester. Student evaluations will address the textbook, course materials and instructional design to ensure that the learning outcomes are reached. Students of all sections will take the examination certified by the ACS. Course sections assessments will be based on: (1) Overall student performance and (2) Performance/Retention in higher level chemistry courses. In addition to student evaluations, instructional assessments will be made based on a particular class's performance compared with the overall performance on the ACS final examination.

Quantitative Evaluation: The PCC is currently acquiring data that will show the current withdrawal and failure rates for the last two semesters. This data can be compared with rates following the adoption to a no-cost textbook. Measurements will then be correlated for textbook effectiveness.

Qualitative Evaluation: Instructors are collecting surveys this semester and will continue in effort to measure students' attitudes with regard to on-line materials. Attitudes toward these materials will be compared to the text currently required for the chemistry courses. The PCC will develop a list of questions that would adequately measure these attitudes during the spring 2015 semester. Instructors will hold discussions with students of varying performance after each examination to obtain a record of unbiased feedback. A plan will be formulated to improve performance and general attitudes toward course materials as needed based on feedback. A computer tablet with accessories designed for travel is requested for compiling all data and materials associated with the plan.

1.3 TIMELINE

Dates	Action
8/10/2015 – 11/20/2015	Evaluate and upload chemistry 1211 support materials to D2L, Develop student surveys
9/13/2015 – 10/5/2015	Evaluate and approve of pilot textbook for spring adoption in Chemistry 1211 & 1212
10/5/2015 -11/20/2015	Development of course assessment materials for chemistry 1211 &1212
9/7/2015- 3/11/2016	Develop assessment strategies & 1st Status Report
01/4/2016 – 07/22/2016	Implementation, Evaluation & Preparation of Final Status Report

1.4 AMENDED BUDGET

Cecil Jones, PhD	1 course release	$5,000
Supplies	Computer tablet	$2,000
Academic Support	PCC Member	$3,000
Travel (2)	Grant Meeting	$800

Summer compensation of $3,000.00 is requested for the PCC faculty support.

Total Direct Cost = $10,800

1.5 SUSTAINABILITY PLAN

The initial PCC will evaluate the pilot textbook transformation courses (Chemistry 1211 & 1212) and identify areas for improvement to optimize student learning outcomes. The PCC will recommend and implement as needed OER adoptions for all sections of Chemistry 1211 & 1212. Recommendations will be driven continuously by assessment strategies and ACS expectations.

A PCC of rotating chemistry faculty members will be charged with yearly OER training and maintenance. They will monitor sites for new textbook editions and materials to promote student learning. The library has offered assistance with incorporating SSU licensed OERs into D2L. Library assistance is currently provided for the continuous OER training for faculty and students. Modification to assessment strategies will continuously be considered by the PCC to improve course effectiveness and student learning outcomes.

1.6 REFERENCES & ATTACHMENTS

(1) B. L. Lindshield and K. Adhikari, **2013**, **Online and Campus College Students Like Using an Open Educational Resource Instead of a Traditional Textbook MERLOT Journal of Online Learning and Teaching**, 9(1), 26-38.

(1) T. J. Bliss, R.T. Jared, J. Hilton and D.A. Wiley, **2013**, The Impact of Open Textbooks on Secondary Science Learning Outcomes, Educational Researcher, **yr:2014 vol:43 iss:7 pg:341-351**

(2) E. Scanlon, **2012**, Distance Education, 33(2), 221–236.

Scanlon, E et al 2015 Designing for Educational Technology to Enhance the Experience of Learners in Distance Education: How Open Educational Resources, Learning Design and Moocs Are Influencing Learning. Journal of Interactive Media in Education, 2015(1): 6, pp. 1-9

Final Report

Date: August 11, 2016

Grant Number: 162

Institution Name(s): Savannah State University

Team Members (Name, Title, Department, Institutions if different, and email address for each): Drs. Cecil Jones, Zhiyan Song, and Adegboye Adeyemo

Project Lead: Dr. Cecil L. Jones

Course Name(s) and Course Numbers: Principles of Chemistry 1211 and 1212

Semester Project Began: Spring 2016

Semester(s) of Implementation: spring and summer 2016.

Average Number of Students Per Course Section: Spring = 36 and Summer = 19

Number of Course Sections Affected by Implementation: Spring =7 sections and Summer = 3 sections

Total Number of Students Affected by Implementation: 232

1. Narrative

The transformation from the commercial text, Chemistry, 11th Edition by Raymond Chang and Kenneth A. Goldsby (ISBN 978-0-07-340268-0) to the OpenStax Chemistry text was simple. Meetings held well in advance of the first day of classes ensured that the course instructor had access to the on-line text in addition to a hard copy version in our department. The on-line location of the text was included on all syllabi for Chemistry 1211 and 1212 making it readily accessible to students in these courses.

Instructors generally agree that teaching at an acceptable pace dramatically improved due to the availability of the OpenStax text. Before adopting the text, students often fell behind in homework so critical for success in chemistry. This lag in completed homework exercises was due to a wait for financial aid that would allow students to purchase the once required commercial text. The availability of the text on the first day of class allows the instructor to provide supportive homework for that first and following lectures.

A survey was conducted during the spring semester of 2016 to measure students' attitudes about open educational resources (OERs). A total of 232 students were surveyed and only 21% of them were aware of OERs for any course. A significant group among them (26%) were planning to complete the course without purchasing a text; the chief compliant being that the commercial text was too expensive. Typically, these students suffer from low performance on Chemistry examinations. The survey showed that 93% of the students were made more comfortable with

the course and 95% expected good performance as a result of having the OpenStax text available.

The course is instructed primarily from the OpenStax text, however, I have also referred instructors to the OER Chemistry text at (http://www.oercommons.org/courses/general-chemistry-principles-patterns-and-applications/view). The text titled "General Chemistry Principles, Patterns and Application" was initially considered for adoption. However, too many errors were found in the text and we decided to go with the OpenStax text instead. Despite the errors in the OER, the text is rich in examples that are useful for learning key concepts in chemistry.

Instructors are also informed of websites that contain support material as seen at (http://www.oercommons.org/courses/the-chemwiki/view). This site not only contain worksheets and homework exercises, but great simulations as well particularly through PhET Simulations. Another useful site even for our other chemistry courses is http://chem.libretexts.org/LibreTexts/University_of_California_Davis.

The initial outcomes were positive as will be discussed in section 3 of this report. For long-term effectiveness, this effort to improve student learning through OERs must continue to evolve and our instructors are committed to methods of enhancing the outcomes initiated through Affordable Leaning of Georgia. We are now exploring the use of affordable packages of on-line homework and quizzing programs for credit to reinforce the concepts of chemistry.

2. Quotes

Students of Chemistry 1212 stated "I wish we had the OpenStax text when I was in 1211". Another common quote is "I don't have to worry about how I am going to pay of the text". Finally, students often ask "Can you get OERs for the other chemistry course?" I am responding with the probable application for an interdepartmental proposal that would include an introductory chemistry course, biology and behavioral analysis.

3. Quantitative and Qualitative Measures

3a. Overall Measurements

Student Opinion of Materials

Was the overall student opinion about the materials used in the course positive, neutral, or negative?

Total number of students affected in this project: __232_____

- Positive: ___94____ % of __221____ number of respondents
- Neutral: _____ % of _____ number of respondents
- Negative: _____ % of _____ number of respondents

Student Learning Outcomes and Grades

Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Student outcomes should be described in detail in Section 3b.

Choose One:

- __X__ Positive: Higher performance outcomes measured over previous semester(s)
- ___ Neutral: Same performance outcomes over previous semester(s)
- ___ Negative: Lower performance outcomes over previous semester(s)

Student Drop/Fail/Withdraw (DFW) Rates

Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Drop/Fail/Withdraw Rate:

___20____% of students, out of a total __232_____ students affected, dropped/failed/withdrew from the course in the final semester of implementation.

Choose One:

- _X_ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- ___ Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- ___ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

3b. Narrative

Impact of OERs on student learning in the chemistry courses was measured by the number of students who successfully completed these courses before and after adopting the OpenStax text. The percent of unsuccessful students in Chemistry 1211 and 1212 were measured from fall 2014 to spring 2016. Summer 2016 is included in the data as it involved the implementation of the program. Data from previous summers was unavailable because faculty members are not required to submit grade distribution forms during the summer.

The data indicate a substantial decrease in unsuccessful students as a result of using OERs. For example, the average failure rate ranged from 34-to-48% in these courses prior to using OERs. A failure rate of only 20% was recorded following the spring semester where all sections of chemistry had adopted the OpenStax text. Unsuccessful students are defined by students who received a non-passing grade for the course; that would be a “D”, “F” or “W”. Learning objectives are measured through examinations and correlate to the course grade. The data show that student learning has improved. Key to success in this area is that students have access to the text on the first day of class.

The survey conducted during the spring 2016 semester shows that students are more comfortable with the OpenStax and generally have high expectations with regard to their ability to meet the learning goals.

4. Sustainable Plan

Members of the Principles of Chemistry Committee (PCC) will be responsible for reviewing new OERs and offer ways by which these may be incorporated into the two courses. Each instructor is challenged and encouraged to further develop their course and share any new practices with the PCC. The PCC will evaluate and consider these practices for department wide usage, particularly with regard to enhancing student learning and graduation rates.

5. Future Plans

The adoption of OERs for Chemistry has initiated interest in low-cost learning in the departments of math, biology and behavioral analysis. The success described herein has prompt the consideration of an interdepartmental proposal for piloting Introductory Chemistry & Chemical Calculations, Principles of Biology, and Behavioral Analysis. This effort would demonstrate a campus-wide movement toward affordable learning.

6. Dr. Cecil L. Jones collected student surveys and data needed for measuring the impact of OERs used on student success rate in Chemistry 1211 and 1212. He also included on meeting agendas the availability of alternative OERs and measured instructors' attitudes regarding the use of these materials. Instructors are generally excited about the use of OERs and are researching affordable methods to improve student learning in freshman chemistry. Critical information obtained from the Affordable Learning webinars were shared. Dr. Jones will continue to lead the effort at Savannah State University to make learning affordable campus wide.