Required Texts:
- Carbon Copy Lab Notebook (available from the ASU Bookstore or from the lab stockroom) – half used is OK

Also Required:
- A scientific calculator  (Bring your calculator to lab and to class every day)
- Approved Safety Goggles

Course Description: A continuation of the study of the fundamental laws and theories of chemistry, chemical nomenclature, chemical equilibrium, metals and non-metals and their compounds, and introduction to nuclear chemistry.

Prerequisites: Chem 1411 is to be completed with a grade of C or better before Chem 1412. Proficiency in Algebra is required. Only students eligible to take a college-level math course may take Chem 1412.

Student Learning Outcomes:

After completion of this course students will be able to:
- Demonstrate technical and analytical skills in the area of general chemistry.
  - Students will be able to use the periodic table to determine basic atomic information and to predict trends in atomic properties.
  - Students will be able to interconvert between chemical names and formulas to the extent that they can work problems given only one of those pieces of information.
  - Students will be able to classify common types of chemical reactions and predict the outcomes of reactions.
- Analyze complex chemical problems and draw logical conclusions.
  - Students will be able to use an understanding of atomic structure at the basic and atomic levels to analyze the structure and reactivity of substances and chemical species.
  - Students will be able to use an understanding of how energy interacts with matter to predict stable chemical species, and perform thermodynamic calculations describing chemical reactions.
- Employ mathematics in the analysis of chemical problems.
  - The mole concept, chemical formulas and balanced chemical equations will be used to do chemical calculations that relate macroscopic measurements to numbers of atoms, ions or molecules.
  - Students will be able to do calculations involving solution concentration and know how to prepare solutions of given concentrations.
  - Students will be able to quantitatively predict gas properties using gas law calculations.
- Understand and apply scientific reasoning in the chemical sciences.
Students will be able to use an understanding of ions and molecules at the atomic level to predict the behavior of reactions in aqueous solutions.

Students will be able to use the basic ideas of quantum mechanics to describe how molecular bonds form and to predict molecular shape and polarity. Molecular structure and polarity will be used to predict the forces between molecules and relate those forces to the states of matter and phase changes.

Grading:

Three One-Hour Exams 3 x 100 = 300 pts
One Two-Hour Final Exam(comprehensive) 1 x 150 = 150 pts
Quizzes 8 x 20 = 160 pts
(9 quizzes will be given and the lowest quiz grade will be dropped)
Smartwork Online Homework Grade 190 pts
Lab Grade 200 pts
(Lab 16 is worth 50 pts; the other labs are worth 25 pts. The lowest regular 25 pt lab grade will be dropped.)

Total = 1000 pts

Total scores within the following ranges at the end of the semester guarantee the student at least the indicated letter grade:

A 900-1000 pts (90% of the total or better)
B 800-899 pts (80-89% of the total)
C 700-799 pts (70-79% of the total)
D 600-699 pts (60-69% of the total)
F 0-599 pts (less than 60% of the total)

Deadline: Last Day to drop the course: Monday, July 30

Attendance Policy: Roll will be taken each class period.

Persons with disabilities which may warrant academic accommodations must contact the Student Life Office, Room 112, University Center, in order to request and to implement academic accommodations.

Quizzes Quizzes will be given as shown in the course schedule in this syllabus. Quizzes will be worth 20 points and the quiz topic will be announced during the previous day’s class. The student’s lowest quiz grade will be dropped. Make-up quizzes will not be given for any reason.

Calculators Students are expected to bring a scientific calculator to class every day, including days with quizzes or exams. Students may NOT use cell phones in place of calculators during quizzes or exams.

Make-up Exam Policy: Students will only be allowed to take one make-up exam if there is an illness or emergency which is documented in writing. In order for a student to be eligible to take a make-up exam, the student must notify Dr. Maxwell before the exam is missed by telephone, voice mail or email. When a student returns to class after missing an exam, he or she must present a document such as a doctor’s note or funeral notice in order for Dr. Maxwell to give permission for a make-up exam. All make-up exams will be given on Friday, August 3 at 11:00 am. Students will not be given a second chance for a make-up exam. Each student may take no more than one make-up exam for any reason whatsoever.
Policy on Academic Dishonesty: Students are expected to work independently on quizzes, exams and lab reports. See the ASU Student Handbook for definitions of cheating and plagiarism. Any student who is caught cheating or plagiarizing in this class will be subject to failure in the course and possible suspension from the University. Cheating and/or plagiarism will not be tolerated! Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding the Academic Honor Code, which is contained in both print and web versions of the Student Handbook.

Online Homework System: Smartwork is an online homework program which accompanies the Gilbert textbook. The point values for each homework assignment are shown in the schedule in this syllabus. Although each homework assignment appears to be worth different values on the smartwork system, they will be normalized when entered into blackboard. To enroll in Smartwork, go to http://wwnorton.knowledgeowl.com/help/smartwork5-students-getting-started.

You will need
1. A valid email address
2. The enrollment key for your course: CHEM54037.
3. A registration code from W.W. Norton or the use of a credit card.
   This proof-of-purchase allows you to access the course after your free two-week trial period expires.

The assignments and due dates for Smartwork can be found on the Smartwork home page for our course. Each homework assignment will be worth 25 pts except for the last assignment, which will be worth 15 points. Homework grades cannot be dropped. The enrollment key for our course is CHEM54037.

Blackboard: Blackboard is a computer learning environment to help you with your studies. To log onto blackboard, type in http://blackboard.angelo.edu into your web browser. Do not type in www. Then click the grey "Login" button to the left of the screen. Next type in your username and password. Your username and password are assigned by IT. Please see Dr. Maxwell if you have trouble logging onto Blackboard.

Cell phone policy: In regular class sessions and during exams, all cell phones must be set to silent alert. If a student's cell phone rings audibly during class, that student will be asked to leave class for that day. If a student's cell phone rings audibly during an exam, the student will have to turn in their exam and not be allowed to make up the exam. Students are not allowed to use cell phones during exams and quizzes for any reason whatsoever. Thank you for respecting the rights of your fellow classmates by turning off the ringer on your phone during class.

Lab Course: The lab course will give you practical experience in many common laboratory techniques involved in the qualitative analysis of unknown mixtures. Attendance in lab is a mandatory part of this course. The grade you receive in lab will be counted as a 200 pt. score. Labs will begin meeting the first day of the semester. Bring your calculator! There will be a lab exam at the end of the semester that is worth 25
points. The lowest lab grade will be dropped except for Lab 16 or the Lab Exam. Neither Lab 16 or the Lab Exam cannot be dropped.

Mandatory Laboratory Safety Training and Quiz: All students who have not done previously done so must take the Blackboard Laboratory safety training and quiz. Click on “Lab Safety Training”. Under the left hand menu, choose “Get Started Here”. There are three sections: 1) Welcome to Lab Safety Training -- There are your instructions. 2) Lab safety training -- Click on “Lab Safety - Click here to begin” -- This will download a Powerpoint slide show which will cover the safety training. 3) The lab safety quiz. You must score 90% or higher. **Students who are required to pass the Safety Quiz will not be allowed to attend lab without passing the quiz starting Wednesday, July 11. There will be no exceptions to this rule.**

Lab Manual and Lab Reports: The lab manual provides a description of the background for each experiment, pre-laboratory questions that will be turned in at the beginning of the lab period, a procedure for the experiment, and a lab report form which must be handed in when the lab is completed. You will also need to record data in a lab notebook, and hand in the carbon copies from that notebook when the lab is complete. It is essential that you read the appropriate section in the manual before coming to class.

Laboratory Attire: Beginning on the first day of lab, everyone MUST have approved goggles, long-sleeved shirts which cover the midriff, long pants, and shoes with closed toes and heels (no sandals, slides, etc.). (Basically, you should have as little exposed skin as possible.) Anyone not wearing the appropriate attire will not be allowed into lab.

Lab Clean up: Before a student can leave the lab at the end of the experiment, he or she must make sure that the bench area is clean, that all electrical equipment has been unplugged and all faucets turned off, and that no solids have been left in the sinks. In the common areas, all of the hoods and balances must be clean and all reagent bottles must be capped. If reagent bottles are found uncapped during or after the lab or if the common areas are found dirty or with things that are not supposed to be there at the end of the lab, then clean-up points will be deducted from the grades of all lab students in that section for that experiment. If a particular bench is found dirty or with things that are not supposed to be there, then clean-up points will be deducted from all the students using that bench. If the instructor can determine who is responsible for a particular mess, then the clean-up points will be deducted only from the grades of the student or students responsible. If not, then clean-up points will be deducted from all students in the section for messes in common areas and from all students on a particular bench for messes on that bench. No points will be deducted for broken glassware as long as it is cleaned up and reported to the instructor.

Make-up Lab Policy: The lowest lab score will be dropped from the total. If you miss a lab for a valid reason, that is the score that will be dropped. Lab 16 and the Lab Exam cannot be dropped.
<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture:</th>
<th>Lab:</th>
</tr>
</thead>
</table>
| **T** July 10 | Chapter 10 (Secs 10.4-10.7): Solubility, Vapor Pressure and Phase Diagrams  
Chapter 11: Solutions - Vapor pressure, solubility of gases in water, dissolution of ionic compounds, mixtures of volatile solutes, colligative properties | Exp 1: Qualitative Analysis of an Unknown Salt (50 pts) |
| **W** July 11 | **Quiz 1 (end of class)**  
Chapter 12: Solids  
The solid state, structures of metals, alloys, metallic bonds, semiconductors, ionic solids, structures of nonmetals  
**Smartwork Ch 10 and 11 HW due 11:59 pm (25 pts combined)** | Qualitative Analysis (cont.) |
| **R** July 12 | **Quiz 2 (end of class)**  
Chapter 12, cont | Qualitative Analysis (cont.) |
| **F** July 13 | **Quiz 3 (end of class)**  
Chapter 13: Chemical Kinetics – Reaction rates, effect of concentration on rate, the Arrhenius equation, reaction mechanisms, catalysis  
**Smartwork Ch 12 HW due 11:59 pm Sunday July 15 (10 pts)** | |
| **M** July 16 | Chapter 13, cont.  
**Smartwork Ch 13 HW due 11:59 pm (25 pts)** | 11:00 am Optional Review Session for Exam 1 |
| **T** July 17 | | Exam 1, 11:00 am  
Cav 200 |
| **W** July 18 | Chapter 14: Chemical Equilibrium – Writing equilibrium constant expressions, relationships between $K_c$ and $K_p$ values, manipulating equilibrium constant expressions, reaction quotients, heterogenous equilibria, Le Châtelier’s principle | Qualitative Analysis Lab Report due at 11:00 am  
Exp 2: Using Visible Spectroscopy to Quantify FD&C Red 40 (25 pts) |
| **R** July 19 | **Quiz 4 (end of class)**  
Chapter 14, cont.  
**Smartwork Ch 14 HW due 11:59 pm (25 pts)** | FD&C Red 40 Lab Report Due 11:00 am  
Exp 3: Kinetics of Crystal Violet (25 pts) |
| **F** July 20 | **Quiz 5 (end of class)**  
Chapter 15: Acid-Base Equilibria – the Brønsted Lowry model, pH and the autoionization of water, calculations involving pH, $K_a$ and $pK_a$, polyprotic acids, acid strength and molecular structure, pH of salt solutions | |
<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture:</th>
<th>Lab:</th>
</tr>
</thead>
</table>
| **M** July 23 | Chapter 15, cont.  
Smartwork Ch 15 HW due 11:59 pm (25 pts) | 11:00 am Optional Review Session for Exam 2 |
| **T** July 24 | | Exam 2, 11:00 am Cav 200 |
| **W** July 25 | Chapter 16: Additional Aqueous Equilibria - the common ion effect, buffers, indicators, acid-base titrations, Lewis acids and bases, solubility equilibria  
**SKIP Sections 16.6 & 16.7** | Crystal Violet Lab Report Due 11:00 am  
Exp 4: Equilibrium and Le Châtelier’s Principle (25 pts) |
| **R** July 26 | **Quiz 6 (end of class)**  
Chapter 17: Thermodynamics – Spontaneous processes, entropy, the Third Law of Thermodynamics, calculating entropy changes, free energy, temperature and spontaneity, free energy and chemical equilibria, the standard hydrogen electrode, the influence of temperature on equilibrium constants, relating battery capacity to quantity of reactants, corrosion, electrolytic cells  
Smartwork Ch 16 HW due 11:59 pm (25 pts) | Equilibrium Lab Report Due 11:00 am  
Exp 5: Titration Curves (25 pts) |
| **F** July 27 | **Quiz 7 (end of class)**  
Chapter 17, cont. | |
| **M** July 30 | Chapter 17, cont.  
Smartwork Ch 17 HW due 11:59 pm (20 pts) | 11:00 am Optional Review Session for Exam 3 |
| **T** July 31 | | Exam 2, 11:00 am Cav 200 |
| **W** Aug 1 | Chapter 18: Electrochemistry – Balancing redox reactions, electrochemical cells, standard potentials, chemical energy and electrical work, the Nernst equation | Titration Curves Lab Report Due 11:00 am  
Exp 6: Gibb’s Free Energy Lab (25 pts) |
| **R** Aug 2 | **Quiz 8 (end of class)**  
Chapter 18, cont.  
Smartwork Ch 18 HW due 11:59 pm (25 pts) | Gibb’s Free Energy Lab Report Due 11:00 am  
Exp 7: Electrochemistry Lab (25 pts) |
Table:

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Event</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Aug 3</td>
<td><strong>Quiz 9 (end of class)</strong></td>
<td>Chapter 19: Nuclear Chemistry – Binding energy and nuclear decay, radioactive decay, rates of radioactive decay, radiometric dating, measuring radioactivity, biological effects of radioactivity, medical applications of radionuclides, nuclear fusion</td>
</tr>
<tr>
<td>M</td>
<td>Aug 6</td>
<td>Chapter 19, cont.</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Aug 7</td>
<td>Review for Final</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smartwork Ch 19 HW due 11:59 pm (10 pts)</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Aug 8</td>
<td>9:00 am ACS Final Exam</td>
<td>(two semester comprehensive)</td>
</tr>
</tbody>
</table>

Note: the lowest lab grade (except Lab 16) and the lowest quiz grade will be dropped. No exam grades will be dropped. Lab 16 cannot be dropped.

**Evaluation of Student Learning Outcomes**
Student Learning Outcomes will be assessed by a combination of homework assignments, lab reports and exam questions.

**Texas Higher Education Coordinating Board Natural Sciences Objectives**
The objective of the study of a natural sciences component of a core curriculum is to enable the student to understand, construct, and evaluate relationships in the natural sciences, and to enable the student to understand the basis for building and testing theories.

**Exemplary Educational Objectives**
1. To understand and apply method and appropriate technology to the study of natural sciences.
2. To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses, and interpretation both orally and in writing.
3. To identify and recognize the differences among competing scientific theories.
4. To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values, and public policies.
5. To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.

**Department of Chemistry and Biochemistry Learning Goals and Objectives**

DLG2a: Students will be able to understand and apply scientific reasoning in the chemical sciences.
DLG2b: Students will be able to employ mathematics in the analysis of chemical problems.
DLG3: Students will be able to demonstrate technical and analytical skills in chemistry and biochemistry.

Students will be assessed in these goals and objectives on a four point scale. These assessments will be reported on Blackboard to each individual student at the end of the semester.
4 – Exceeds departmental expectations.
3 – Meets departmental expectations
2 – Does not meet departmental expectations
1 – Substantially below departmental expectations.