

**Forensic Chemistry BS
Assessment Plan Summary**

Forensic Chemistry BS

(1) Deliver A Curriculum Appropriate For Understanding Fundamentals Of Chemistry

Goal Description:

The curriculum will address the discipline specific fundamental knowledge dictated by professional societies and/or professionals in the workforce .

RELATED ITEMS/ELEMENTS-----

RELATED ITEM LEVEL 1**Demonstrate Understanding Of Fundamentals****Learning Objective Description:**

Chemistry is an intensely sequential discipline. Students must master the material at an average level of understanding in the first semester course (general chemistry I) before they are allowed to attempt the second semester course (general chemistry II). The same is true for each of the first five semester courses in the sequence (general chemistry I, general chemistry II, organic chemistry I, organic chemistry II and physical chemistry I).

The fundamental concepts covered in general chemistry I and II include:

uncertainty in measurement, dimensional analysis, atomic and electronic structure, ionic and molecular formulas, nomenclature, stoichiometry, thermochemistry, bonding theories, valence shell electron pair repulsion theory, properties of gases, intermolecular forces, properties of solutions, kinetics, equilibrium, acid-base chemistry, oxidation-reduction chemistry, chemical thermodynamics and electrochemistry.

RELATED ITEM LEVEL 2**ACS General Chemistry Test****Indicator Description:**

All forensic chemistry majors will be invited to take a nationally standardized test over general chemistry (written by the American Chemical Society Division of Chemical Education Examinations Institute) near their completion of general chemistry II. In order to encourage participation, the highest individual score is guaranteed scholarship money for a future semester, and additional scholarship monies will be scaled to percentile performance on the examination.

Criterion Description:

Sixty percent of forensic chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the ACS standardized general chemistry exam. The major weakness in 2010-2011 was the low number of majors who took the exam. We continue to work to motivate more students to take the exam.

Findings Description:

In the fall semester, I did not contact the chemistry and forensic chemistry majors who were enrolled in general chemistry II. The ACS test was not given to these students. The reason why is that I forgot. We were conducting two faculty searches at that time and this completely slipped my mind.

For the spring semester, of the 11 students that took the exam (41 were invited to do so), 8 (73%) scored within one standard deviation of the mean or higher on the ACS standardized general chemistry examination. The criterion was met and exceeded overall. For chemistry majors (excluding forensic chemistry majors), 4 students took the exam (13 were invited to do so) and all 4 of them (100%) scored within one standard deviation of the mean or higher. Thus the criterion was met for the chemistry majors. Overall the participation rate for the spring semester was $11/41 = 27\%$ (and $4/14 = 31\%$ for chemistry majors and $7/28 = 25\%$ for forensic chemistry majors). This is up slightly from last year (25%). We need to keep working on the ways to encourage and allow participation in this exam.

Attached Files

[!\[\]\(9f3852d68d41e1e95bc4ec10e81aba4b_img.jpg\) ACSGeneralExam16](#)

RELATED ITEM LEVEL 3**Fundamental Knowledge****Action Description:**

We think that sitting for the ACS General Chemistry exam for chemistry and forensic chemistry majors as they finish CHEM 1412 (General Chemistry II) is important. We think that the scholarship money is a good incentive. This year participation is up for the spring semester but was non-existent for the fall semester (because the test was not offered). We will make sure to offer the exam in the fall, and we will ask all of the CHEM 1412 instructors to encourage the chemistry and forensic chemistry majors in their class to participate.

(2) Deliver A Curriculum Appropriate For Understanding Organic Chemistry

Goal Description:

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area of organic chemistry.

RELATED ITEMS/ELEMENTS -----

RELATED ITEM LEVEL 1

Demonstrate Understanding Of Organic Chemistry

Learning Objective Description:

Organic chemistry is covered in the second year of a chemistry degree. It follows a year of general chemistry and precedes physical chemistry.

Students will demonstrate competent knowledge of the topics covered in organic chemistry I and II which include: hydrocarbons (alkanes, alkenes and alkynes), aromatic systems, functional group chemistry (including the chemistry of alkyl halides, ethers and various carbonyl compounds), stereochemistry, and carbohydrate chemistry.

RELATED ITEM LEVEL 2

ACS Organic Chemistry Test

Indicator Description:

A nationally standardized test over organic chemistry (written by the American Chemical Society Division of Chemical Education Examinations Institute) will be given to all chemistry majors who take organic chemistry II at Sam Houston State University. This test is given as the final examination for the course.

Criterion Description:

Seventy-five percent of chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the ACS standardized organic chemistry examination. We will closely follow the performance of forensic chemistry majors who scored slightly lower than chemistry majors in 2010-2011.

Findings Description:

In the fall semester, six chemistry majors and eight forensic chemistry majors took the exam. Four of the six chemistry majors ($4/6 = 67\%$) and one of the eight forensic chemistry majors ($1/8 = 12\%$), for a total of five of fourteen (36%) overall scored within one standard deviation from the mean or higher for the exam. In the spring semester, nine chemistry majors and twenty-five forensic chemistry majors took the exam. Six of the chemistry majors ($6/9 = 67\%$) and sixteen of the forensic chemistry majors ($16/25 = 64\%$) for a total of 22 of 34 (65%) scored within 1 standard deviation from the mean or higher than one standard deviation above the mean. In total, for these students $10/15 = 67\%$ of the chemistry majors and $17/33 = 52\%$ of the forensic chemistry majors, or $27/48 = 56\%$ overall, met the criterion.

The criterion was not met for either group.

It is worth noting that 8 students that failed to score high enough in the fall semester repeated in the spring semester, and 5 (2 chemistry and 3 forensic chemistry majors) of these 8 students successfully scored within one standard deviation from the mean or higher. Three (two chemistry and one forensic chemistry majors) did not, and will need to repeat the course yet again or change majors.

If the students who are double counted are only counted for the spring, the results are $9/12 = 75\%$ for the chemistry majors and $17/28 = 61\%$ for the forensic chemistry majors. Thus, the chemistry majors meet the criterion while the forensic chemistry majors do not.

Attached Files

 [_ACSOrganicExam16](#)

RELATED ITEM LEVEL 3

Organic Chemistry

Action Description:

For the fourth year in a row, we have data for all of the sections of CHEM 2325 (organic chemistry II) that were taught, and again the biggest correlation with low performance on the standardized exam is the section that fills most quickly when there are multiple sections. This continues to suggest that some degree of student self-selection--perhaps they are choosing instructors that they perceive to be "easiest" or perhaps it is a time of day issue--is a factor, and we have no way to modify that factor. We will continue to monitor the situation. All of the students who fail to meet the criterion either repeat the course (and subsequently meet the criterion) or they change their majors. We will continue to assess student's performance.

By the way, one of the instructors is using a flipped classroom approach. So far there is no observable difference in student performance on the standardized exam.

(3) Deliver A Curriculum Appropriate For Mastery Of Advanced Chemistry Topics

Goal Description:

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area of advanced chemistry topics.

RELATED ITEMS/ELEMENTS -----

RELATED ITEM LEVEL 1

Demonstrate Mastery Of Advanced Topics In Chemistry

Learning Objective Description:

The material learned by the third year in the chemistry curriculum is refined and supported theoretically in Physical Chemistry I (CHEM 4448). The successful student will demonstrate a mastery of the advanced topics presented in this course. These topics include quantum theory, wave functions, the dipole approximation, electronic configuration, molecular structure, molecular orbital diagrams, symmetry, group theory, and the application of these topics to X-ray, ultraviolet, visible, infrared, Raman, and magnetic resonance spectroscopy. All sections of CHEM 4448 have been taught by Dr. Darren Williams since his arrival at SHSU in 2004.

RELATED ITEM LEVEL 2

CHEM 4448 Final Examination

Indicator Description:

CHEM 4448 is required of all chemistry majors. The final examination in Physical Chemistry I (CHEM 4448), written by Dr. Darren Williams, is recognized by the faculty of the Department of Chemistry as being comprehensive and covers all of the advanced topics listed in the objective statement. Dr. Williams is the sole instructor of CHEM 4448 at SHSU having taught all sections of CHEM 4448 since his arrival on campus in 2004. All students are required to complete the final examination. Examples of final exams are on file and secured within the Department of Chemistry and may be viewed by contacting Dr. Williams directly at williams@shsu.edu.

Criterion Description:

Seventy-five percent of chemistry majors are expected to demonstrate a mastery of at least sixty percent of the material (score 60%) on the comprehensive final examination.

Findings Description:

The criterion was met in 2016 with 86% of majors scoring at least 60% on the comprehensive final exam. The full statistics for all semesters sing 2004 are attached as well as a box plot of the performance.

Attached Files

- [FinalExamGradeTrends](#)
- [CHEM 4448 Performance 2004-2016](#)

RELATED ITEM LEVEL 3

Physical Chemistry Action

Action Description:

The previous action item (of continuing the 10-pages of hand-written work per week) was appreciated by two of the six student commenters who addressed homework. Many of the negative comments were about the amount of pages. The positive comments were related to the educational purpose of the homework, namely to keep the student engaged with the material between exams. Therefore, this practice will be continued.

New action for 2016

Issue: There are many negative comments related to the laboratory work, and this will be addressed in the coming year through the creation of a Physical Chemistry Laboratory Manual. From 2004 to 2007, the professor gave a lecture at the beginning of lab. From 2008 to 2015, the TA's were delivering the lab lecture and preparatory information.

Action: It is time to further codify the preparatory information in the form of a laboratory manual. It is predicted that this will improve the course experience and learning outcomes because of a better understanding of the laboratory exercises.

(4) Deliver A Curriculum Appropriate For Understanding Instrumental Analytical Methods In Chemistry

Goal Description:

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area of instrumental analytical methods in chemistry.

RELATED ITEMS/ELEMENTS -----

RELATED ITEM LEVEL 1

Demonstrate Understanding Of Instrumental Analytical Methods In Chemistry

Learning Objective Description:

The modern analytical laboratory makes extensive use of electronic instrumentation for the analysis of chemical samples. Our Instrumental Analytical Chemistry course (CHEM 4440) is designed to introduce students to and have them learn the importance and use of spectrophotometric, chromatographic, and mass spectrometric analytical instrumental methods and computers in analytical laboratories. The

course's laboratory component includes a focus on complex technical writing and use of the scientific literature. Students must master this material to meet the objective. Dr. Thomas Chasteen has been the instructor for all sections of CHEM 4440 for more than a decade.

RELATED ITEM LEVEL 2

Examinations In Instrumental Analytical Chemistry

Indicator Description:

All students in Instrumental Analytical Chemistry (CHEM 4440) are required to master the electronic, sampling, schematic, and computational fundamentals of modern analytical instrumentation as evaluated by 80-minute written tests requiring essays, laboratory data evaluation, and calculator-based computation. There are three tests and a final examination in this course. The testing of this knowledge and its application is standardized within the department across all sections.

Criterion Description:

Eighty two and one half percent of chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the four examinations in this class. We expect statistical variability from test to test and from year to year.

Findings Description:

On the first exam, 28 of the the 35 students (80%) scored within one standard deviation of the mean or higher. On the second exam, 30 of the 35 students (86%) scored within one standard deviation of the mean or higher. On the third exam, 31 of the 35 students (89%) scored within one standard deviation of the mean or higher. On the final exam, 32 of the 35 students (91%) scored within one standard deviation of the mean or higher. The criterion was met for each exam except the first (which was 2.5% or 1 student short). Clearly intervention is not needed.

Attached Files

 [CHEM4440 F2015 SACS data](#)

RELATED ITEM LEVEL 3

Monitor Instrumental Analysis Performance

Action Description:

There will be a major change in this course. Dr. Thomas Chasteen will be on a medical leave of absence this coming fall semester (and this is a fall-only course), and he is retiring at the end of the coming year. Consequently, Dr. David Thompson will be teaching the course this fall.

(5) Deliver A Curriculum With Appropriate Written And Oral Communication Skills Developed

Goal Description:

The curriculum will provide opportunities for mastery of written and oral skills.

RELATED ITEMS/ELEMENTS -----

RELATED ITEM LEVEL 1

Demonstrate Adequate Written And Oral Communication

Learning Objective Description:

Students will demonstrate the ability to present to an audience of their peers a talk (seminar) based on their own research or research that has been reported in the scientific literature

RELATED ITEM LEVEL 2

Chemistry Seminar Presentation

Indicator Description:

All chemistry majors are required to take CHEM 4100 "Chemical Literature Seminar". Students typically do so in their senior year. One of the requirements of this course is giving an oral PowerPoint presentation over either their own research, or research from the published chemical literature, to the other students in the class.

Criterion Description:

All chemistry majors are required to receive an acceptable peer-rating on a required research presentation. Within the course, each student evaluates all other student presentations. The rubric is the last page of the syllabus. Over the years, in general we have found that peers tended to rate presenters rather highly. We hope to see more helpful feedback after providing additional instruction in constructive feedback.

Attached Files

 [4100.01](#)

Findings Description:

No significant change in CHEM 4100 student comments were observed this past year despite the increased in depth emphasis on constructive student comments.

RELATED ITEM LEVEL 3

Seminar Action

Action Description:

The instructor that has been in charge of CHEM 4100 for more than the past decade will be taking a leave of absence in the fall semester of 2016, and will be retiring at the end of the next academic year. Consequently, a new individual will be in charge. We will monitor the situation.

Update to Previous Cycle's Plan for Continuous Improvement

Previous Cycle's Plan For Continuous Improvement (Do Not Modify):

As stated previously, we assess the same courses year after year for our B.S. programs because the courses, the material, and the requirements of the American Chemical Society do not change. This means that our plans from year to year end up being remarkably similar.

A suggestion was made in the meta-assessment that we do something specific related to forensic chemistry to distinguish it from the B.S. in chemistry. The forensic chemistry major takes most of the same chemistry courses that the chemistry major takes (while the chemistry major takes even more courses in chemistry). The exception is CHEM 4380 "Forensic Chemistry" which students take in their last semester. Chemistry majors are also allowed to take this course as an elective. The main thing that distinguishes a forensic chemistry major from a chemistry major is the requirement of a criminal justice minor and the requirement to take genetics (with all of the prerequisites that that entails). These courses are outside of the chemistry department, and consequently are outside of our normal assessment activities. For CHEM 4380, since it is the last course that a student takes and it is only offered in the spring semester, I don't recall any student ever failing the course, and if they make a D, they will graduate as long as they made a B in at least one of their 3 or 4 credit courses (since their gpa will then be 2.00 or above).

This past year we offered students two opportunities in the fall and in the spring for qualified students to take ACS exam over general chemistry, but participation rates fell compared to last year. This coming year we will again offer two opportunities to take the exam each semester, but we will endeavor to better advertise it to the students through multiple emails and instructor announcement(s).

In the area of organic chemistry, we will continue to monitor student performance on the standardized final and check instructor and time correlations. This may be a consequence of the registration process--more senior students register first which means that students who did poorly and are repeating the class register first and they may show up disproportionately in the class that fills fastest. This coming year we will pay more attention to the academic history of the students taking the exam.

In the area of physical chemistry, Dr. Williams will continue to stress issues related to time management through required homework assignments.

In the area of instrumental analysis, we will raise the criterion this year.

For the seminar, there will be an increased emphasis on constructive student comments.

Update of Progress to the Previous Cycle's PCI:

While we normally offer students two opportunities in the fall and spring to take the ACS exam over general chemistry, this year we didn't offer it in the fall.

Plan for Continuous Improvement

Closing Summary:

As stated previously, we assess the same courses year after year for our B.S. programs because the courses, the material, and the requirements of the American Chemical Society do not change. This means that our plans from year to year end up being remarkably similar.

This coming year we will again offer two opportunities to take the ACS exam over general chemistry each semester, but we will endeavor to better advertise it to the students through multiple emails and instructor announcement(s).

In the area of organic chemistry, we will continue to monitor student performance on the standardized final and check instructor and time correlations. This may be a consequence of the registration process--more senior students register first which means that students who did poorly and are repeating the class register first and they may show up disproportionately in the class that fills fastest. As mentioned above, in tracking students who failed to meet the criteria, they do better on repetition. However, not all of them rose to the challenge, and will either have to repeat the course once more, or they will change their major.

In the area of physical chemistry, Dr. Williams will continue to stress issues related to time management through required homework assignments. Difficulties in the laboratory will be addressed through the creation of a Physical Chemistry Laboratory Manual.

In the area of instrumental analysis, there will be a major change in the coming year since the long-time instructor for the course will be taking a medical leave of absence.

For the seminar, there will also be a change in the coming year since the long-time instructor for the course will be taking a medical leave of absence.

I will address one last point. In the meta assessment for this past year, it was implied that the Chemistry Department should set some goal--"to be the best Chemistry Department in some specific area of student performance". The curriculum is largely set by an outside agency. B.S. forensic chemistry majors have no elective courses. In this environment, we do an incredibly good job at producing students who get jobs in their field or go on to graduate school. We have the best forensic chemistry program in the state of Texas.