

UW Colleges Assessment Planning and Reporting Form
2005-2006

Email your reports to SAC@uwc.edu

Department	Chemistry
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NOTE: Please attach relevant supporting information used to complete the Report Summary Sheet.

PART 1: Assessment of General Education Outcomes

Section 1: Identify the Proficiencies and Performance Indicators Assessed

- ❖ at the **Planning** stage, mark the performance indicators to be assessed in the left hand column below
- ❖ at the **Reporting** stage, report the numbers of students who did not meet, met, or exceeded expectations

Proficiency	Performance Indicators	Courses Fall Semester	Courses Spring Semester
A. Analytical Skills	1. Interpret and synthesize information and ideas.	CHE 124, 125, 145, 211, 351	CHE 124, 125, 155, 211, 352, 361

Spring 2006

Proficiency	Exceeds	Meets	Fails to meet
A-1	48% (195)	43% (176)	9% (37)

Fall 2005

Proficiency	Exceeds	Meets	Fails to meet
A-1	50% (269)	42% (228)	8% (45)

Overall

Proficiency	Exceeds	Meets	Fails to meet
A-1	49% (464)	43% (404)	9% (82)

Section 2: Explain how, in general, the institutional rubric was applied to assessment activities. Please attach examples of assessment activities (i.e. modified rubric, assignment, questions) and measurements used to place individuals into the three categories (exceeds, meets, fails to meet). **When completing this section, it may be best to explain the results by course (or course cluster if there were similar tools or results) rather than by instructor.**

All the college assessment was carried in the laboratory.

CHE 124

Proficiency	Exceeds	Meets	Fails to meet
A-1	36% (10)	50% (14)	14% (4)

CHE 125

Proficiency	Exceeds	Meets	Fails to meet
A-1	45% (114)	39% (98)	16% (40)

1. Performance Indicator: Interpret and synthesize information and ideas.

Exceeds Expectations	<ul style="list-style-type: none"> • Synthesizes information and ideas (i.e., evidence, statements, graphics, and questions) very well • Interprets the information and ideas accurately
Meets Expectations	<ul style="list-style-type: none"> • Synthesizes information and ideas (i.e., evidence, statements, graphics, and questions) adequately • Interprets most of the information and ideas accurately
Fails to Meet Expectations	<ul style="list-style-type: none"> • Fails to synthesize information and ideas (i.e., evidence, statements, graphics, and questions) • Fails to interpret information and ideas accurately

Exceeds Expectations:

Student is able to draw a graph correctly for their data.
Perform the calculations based on their data.
Interpret the graph to determine the stoichiometry of the reaction.
Answer the prelab questions with a score of 9 or 10.

Meets Expectations:

Student can draw the graph, but there are minor mistakes on the graph.
Calculations have minor mistakes.
Interpret the graph to determine the stoichiometry of the reaction.
Answer the prelab questions with a score of 7 to 8.

Fails to meet expectations:

Student's graph is poorly drawn with major mistakes, such as wrong labels, incorrectly plotted data points.
Significant errors in calculations.
Can not draw conclusions from the plotted data.
Low score in the prelab.

Note. Instructors used their discretion in grading the exercise.

CHE 145

Proficiency	Exceeds	Meets	Fails to meet
A-1	59% (202)	39% (134)	3% (9)

CHE 155

Proficiency	Exceeds	Meets	Fails to meet
A-1	37% (72)	53% (104)	10% (19)

CHE 211

Proficiency	Exceeds	Meets	Fails to meet
A-1	52% (53)	41% (41)	7% (7)

CHE 341

Proficiency	Exceeds	Meets	Fails to meet
A-1	44% (4)	44% (4)	11% (1)

College Rubric		
	Analytical Assessment A1	Rubric interpretation
Exceeds Expectations	<ul style="list-style-type: none"> Synthesizes information and ideas (i.e., evidence, statements, graphics, and questions) very well Interprets the information and ideas accurately 	<p>Student correctly predicts the IR spectrum of a molecule.</p> <p>Student correctly identifies the molecule based on the IR spectrum</p>
Meets Expectations	<ul style="list-style-type: none"> Synthesizes information and ideas (i.e., evidence, statements, graphics, and questions) adequately Interprets most of the information and ideas accurately 	<p>Student predicts most peaks on the IR spectrum.</p> <p>Student is able to identify peaks but fails to predict the structure of the molecule</p>
Does Not Meet Expectations	<ul style="list-style-type: none"> Fails to synthesize information and ideas (i.e., evidence, statements, graphics, and questions) Fails to interpret information and ideas accurately 	<p>Student predicts a few peaks but does not account for peaks in the IR spectrum.</p> <p>Peaks are not identified correctly and structure prediction is poor.</p>

CHE 352

Proficiency	Exceeds	Meets	Fails to meet
A-1	75% (6)	25% (2)	0% (0)

CHE 361

Proficiency	Exceeds	Meets	Fails to meet
A-1	25% (3)	58% (7)	17% (2)

1. **Use by instructors** - Summarize the ways individual instructors plan to use assessment results to improve the instructional process.

The college assessment in the chemistry department took place in the laboratory. Most instructors indicated an improvement with the results. However, because of teaching loads and assignments, there were some inconsistencies since we assessed two years ago. Also changes in the rubric did not allow for direct comparison.

The assessment exercise is also providing instructors with a good feedback on the general practices of students with respect to laboratory work. Instructors are encouraging students to prepare before lab in order to use their lab time more efficiently.

The following comment is the summary provided by the convener for CHE 155, which is assessed in all 13 campuses.

The practical laboratory assessment exercise utilizing titration has been used by the Chemistry Department for the last two years, with some improvements made for the second run. Overall, students do well on the exercise. The biggest issue right now is to try and standardize our analysis of the results from campus to campus and chemist to chemist. There are variations in different instructors' definitions of what meets various items in the scoring rubric. As a Department, probably at the January meeting, we need to get the folks involved in this exercise involved in a conversation to more specifically define how the exercise is scored. In Spring, 2006, we had the following, very encouraging, results:

40.3% Exceed Expectations (13–15 pts)
52.2% Meet Expectations (8-12 pts)
7.5% Do Not Meet Expectations (0-7 pts)

As far as which parts of the exercise students most frequently missed:

Not incorporating a 2:1 mole:mole ratio in the calculation (66.0%)
Errors in Significant Figures (61.0%)
Not mentioning a color change to pink (35.2%)
Other calculation problems (34.6%)
Not doing more than one trial (21.4%)
Not recording initial and final NaOH volume (19.5%)

A full third of the points were tied into the accuracy of the titration since a large part of what we're trying to assess is student technique. Even if they made a mistake in the calculation, if their data gave an accurate answer, they received the credit. Most students did very well, given the following results:

68.6% within 0.003M of correct—full credit
14.5% within 0.006M but not 0.003M of correct—4/5
6.3% within 0.009M but not 0.006M of correct—3/5
3.1% within 0.012M but not 0.009M of correct—2/5
1.3% within 0.015M but not 0.012M of correct—1/5
6.3% greater than 0.015M off correct answer—0/5

This exercise is a very good tool for assessing student performance in the laboratory. As a department, we need to discuss whether our cut-offs for Meet, Exceed, Not Meet are appropriate. Also, given the high accuracy with which students performed, perhaps the limits for the accuracy portion of the grade need to be narrowed a bit. Increasing the points from 15 to 50, with many more specific things involved may increase the time it takes an individual instructor to analyze the results of his/her class, but could vastly increase the uniformity across the department.

2. **Use by department** - What changes will you and/or the department assessment committee recommend to your department. Include changes to:
- assessment process
 - proficiencies selected
 - performance indicators used to measure proficiency
 - assessment activities
 - evaluative rubrics
 - student performance in a specific course (if there is something that stands out with department discussion).

No changes to the assessment process are being recommended at this time, because we are in the middle of the cycle, and because the assessment tool seems to be a good tool.

3. **Course of action** - After discussion of the results by the department, what course of action will **the department** take to improve student performance with respect to the assessed proficiency?

Instructors suggested better preparation from the students before they come to the lab. Some suggestions were to have a prelab quiz, or require for the students to submit a work plan before they come to the lab.

PART 2: Assessment of Department-Specific Outcomes

❖ At the **Planning** stage, complete section 1.

Section 1: Identify department-specific learning objectives.

	Outcomes/Performance Indicators	Courses Fall Semester	Courses Spring Semester
	1. Analyze, synthesize, evaluate and interpret information and ideas.	CHE 123-4, 125, 145, 343	CHE 123-4, 125, 155, 203, 363

Section 2: Insert the rubrics used here and explain how the rubric or standards were used to assess each outcome or performance indicator. Please attach examples of assessment activities (i.e. modified rubric, assignment, questions) and measurements used to place individuals into the three categories (exceeds, meets, fails to meet). **When completing this section, it may be best to explain the results by course (or course clusters if there were similar tools or results) rather than by instructor.**

Departmental Outcome/Performance Indicator	# Exceed	# Meet	# Do Not Meet
1.	396	477	92

Spring 2006

Proficiency	Exceeds	Meets	Fails to meet
1	153	239	50

Fall 2005

Proficiency	Exceeds	Meets	Fails to meet
1	243	238	42

CHE 123-124

Proficiency	Exceeds	Meets	Fails to meet
1	13	92	22

CHE 125

Proficiency	Exceeds	Meets	Fails to meet
1	133	128	16

CHE 145

Proficiency	Exceeds	Meets	Fails to meet
1	145	103	23

CHE 155

Proficiency	Exceeds	Meets	Fails to meet
1	58	85	24

CHE 203

Proficiency	Exceeds	Meets	Fails to meet
1	33	64	3

CHE 343 and 363

Proficiency	Exceeds	Meets	Fails to meet
1	15	8	4

Department Rubric	
Exceeds Expectations	<ul style="list-style-type: none"> • Synthesizes or evaluates information and ideas (i.e., evidence, statements, graphics, and questions) very well • Refutes bias, if present • Analyzes and evaluates alternative points of view • Draws conclusions and examines implications
Meets Expectations	<ul style="list-style-type: none"> • Synthesizes or evaluates information and ideas (i.e., evidence, statements, graphics, and questions) adequately • Detects bias, if present • Identifies or offers alternative points of view, where possible • Draws conclusions
Does Not Meet Expectations	<ul style="list-style-type: none"> • Fails to synthesize or evaluate information and ideas (i.e., evidence, statements, graphics, and questions) • Fails to note bias, if present • Does not recognize alternative points of view. • Fails to draw conclusions

The comments below were made regarding use of the ACS exam for assessing analytical skills by using indicators that measured student's ability to interpret graphs, tables, and diagrams. Selected problems from an American Chemical Society (ACS) exam were used to assess these skills.

1) How did individual instructors report that they plan to use these results to improve the instructional process?

- Many of the efforts put forth by individual instructors were very fruitful as the UW-Colleges students scored higher than the national average on the ACS Standardized exam in three of the four areas selected by the department for evaluation. On one particular question the UW-Colleges students scored 20 points higher than the national average. In three of the categories assessed (retention, energetics/thermo, and dynamics/kinetics), the UW-Colleges students scored 5.2-6.2% points higher than the national average. In the fourth category (equilibrium), the UW-Colleges students scored 2% points lower than the national average. However, there was a 0.6% improvement in equilibrium category from the previous two years. Good news, but still the weakest area for the UW-Colleges students.
- Instructors evaluated their individual results as follows:
- One instructor looks at how the results compare to previous years and focuses on problematic questions in which >50% of the class got the wrong answer. One of the areas of concern was the equilibrium section, in particular, #43 and #46. This instructor will spend more time on evaluating why the students are getting these wrong.
- A second instructor focused on equilibrium in 2006 and yet found little improvement. The same two questions (#43 and #46) were also problematic with the students of this instructor. This instructor plans to evaluate whether the students simply chose to guess at the answers rather than work through the problems, that is, assess the tool as a guess factor when time is a consideration.
- A third instructor reported a similar performance on equilibrium questions #43 and #46 despite enhancement of examples in class, although equilibrium was not the focus for this instructor in 2006 it will be in 2007.
- A fourth instructor observed that the students did quite good on instructor designed exam questions related to equilibrium, yet performed less than stellar on the equilibrium section of the

ACS exam. This instructor plans to change how students are tested on equilibrium and change laboratory activities so they better reinforce the material.

- A fifth instructor indicated a need to examine strategies for teaching equilibrium and energetics/thermodynamics.
- Several instructors indicated a desire to work on understanding why these questions (#43 and #46) were so challenging by having the students redo these questions with more time as a non-multiple choice, show your work type question.

2) What recommendations would you and/or the department assessment committee make to your department for continued improvement of the assessment process, proficiencies, performance indicators, assessment activity, rubric, and/or student performance in the discipline?

One instructor suggested paring-back. There are lots of activities occurring in the department and a narrower focus was suggested so that individuals could process and understand all of the data. Some instructors thought that for the most part they felt comfortable with the assessment process, proficiencies, performance indicators, activity and tools in place; although there was some disagreement on the level of difficulty of the questions selected for evaluation and the particular ACS exam used. Several thought the exam was rather difficult others did not, although more thought that the questions selected by the department for assessment were perhaps some of the more challenging ones on the exam.

One instructor suggested a rubric for certain specific questions that would evaluate the student's methodology and determine whether there was a guess factor or some inherent misconception. In general, instructors thought that there are many activities in the department related to assessment and that the efforts are showing successes and we should celebrate our successes. However, perhaps because of all the activity and the amount of data generated, it seems that too much is being assessed and a narrower focus is needed. In conjunction with question #1 above, it was suggested that we focus on a weaker area for UW-College's students. In particular, design a rubric for a couple of questions to evaluate why the students are failing on the equilibrium questions #43 and #46. By allowing the students to redo the question as a non-multiple choice question and evaluating their methodology, we could have a better understanding of why the students are getting it wrong.

3) After discussion of the results by the department, what course of action will the department take to improve student performance with respect to the assessed proficiency?

Instructors thought that individual and across the department efforts by instructors should continue as they are showing success. Two departmental initiatives that bridge CHE 145 with CHE 155 are the "Numeracy" project and the "Best Practices in Math and Science Teaching" workshop spearheaded by Tom Neal and Carrie Geary. The efforts in these initiatives by participating instructors are expected to improve the performance of chemistry students.

Based solely on CHE 155, the focus in spring 2007 will be on the weakest area for the UW-College's students, that is, equilibrium. The focus will be on whether the tool is properly assessing the student's knowledge, at least on questions #43 and #46. Attempts will be made to understand why students are underachieving on equilibrium questions. Once an understanding of why students are getting these questions wrong, then a targeted approach to improving the results can be designed. By allowing students to redo the problems with plenty of time, as non-multiple choice, show your work questions, we can understand why the students are getting these wrong and thus improve performance.

Section 3: Use of results.

- 1. Use by instructors** - Summarize the ways individual instructors plan to use assessment results to improve the instructional process.

A number of instructors have done some modifications to their teaching. These instructors modified their teaching style, and as a result the assessment scores of their classes went up.

A large number of the instructors involved in teaching CHE 125, CHE 145 and CHE 155, have also used the assessment results to develop an SOTL project in numeracy. This project also involves the Math department; the focus is in developing ways to better communicate numerical concepts to our students, as well as learning how math instructors communicate such concepts to students.

Students in Organic Chemistry struggle with the synthesis problems. Some instructors have indicated that they will start synthetic problems earlier in the class, and emphasize that individual reactions are only small pieces. They will practice synthesis and introduce complete synthesis during class to show how individual reactions are linked together to carry a complete synthesis.

The following are the comments from a CHE 155 instructor

This was the third time I had taught chemistry 155 and the second time using the ACS Standardized Exam as part of my final exam for the course. Only the twenty, required questions were included as part of the final exam. The second part consisted of questions I wrote and focused on the concepts from the spring semester only. Based on the 20 selected questions chosen by the chemistry department, the students at my campus scored above the national averages and the UW-Colleges averages for each category. The selected questions (five in each category) targeted skills in retention, energetics/thermodynamics, dynamics/kinetics, and equilibrium. The clearest assessment was a comparison to the national average. My spring 2006 students averaged about 10% higher than the national standard for the twenty selected questions. The previous year's class (spring 2005) had only a slightly higher average (3%) than the national average. I attribute the increase from 3% higher than the national average in 2005 to 10% higher in 2006 to three things. First, the spring 2006 class had students who were more dedicated. Second, the spring 2006 class scored much better on the retention section than the 2005 class. Third, the students were required to do graded homework from the ACS Study Guide throughout the semester.

I will expound on each of the above contributions to the improved results from 2005 to 2006. First, this particular class had a group of students who were very dedicated to their success. In out-of-class review sessions, it was common to have 7-15 students attend, that is, 25-50% of the class! Many of the students were pre-med, pre-pharmacy, and pre-dental students, that is, highly motivated to succeed. Second, the spring 2005 class scored below the national average in the retention section. The average for the retention section was the lowest of the four categories for my spring 2005 class. It was understandable to me since my tests were only on concepts from that semester. To improve results in this area, I focused on improving the results in the retention section. In each of the chapter objectives in chemistry 155, I included a review section with assigned problems from the previous semester's objectives. The answers to these problems were handed in as graded homework and they were responsible for that review material on quizzes and exams. The average for the retention section was improved from 35% in 2005 to 53% in 2006. Third, in my assigned homework I required students to do several problems from the ACS Study Guide for each chapter. This forced them to use the guide during the entire semester and to become familiar with different ways to ask questions. Also, it helped them become more familiar with multiple choice questions. Although I consider standardized exams as good assessment tools I don't consider them to be as good a learning tool so I do not use a lot of multiple choice questions for testing my students. Using the study guide exposed my students to more multiple choice type questions that they wouldn't ordinarily get from me. Based on these results I plan to continue teaching these concepts as I did in 2006 by assigning review/retention problems and ACS Study Guide problems. As a consequence of my focus on the retention section, it no longer had the lowest average for the four sections. The section with the lowest average for the spring 2006 class was the equilibrium section. Therefore, my focus for spring 2007 will be to improve the results of the equilibrium section.

2. Use by department - What changes will you and/or the department assessment committee recommend to your department. Include changes to:

- a. assessment process
- b. proficiencies selected
- c. performance indicators used to measure proficiency
- d. assessment activities
- e. evaluative rubrics
- f. student performance in a specific course (if there is something that stands out with department discussion).

Some of the instructors have indicated their desire to modify the assessment tool so we can better determine which areas students are not performing at the appropriate level. A few modifications have been suggested and the course conveners will be reviewing the assessment tools for each of the courses. This process started last year when a team of instructors reviewed the assessment tools for CHE 125 and CHE 203 and developed new tools in response to changes done to both courses.

Changes in CHE 125 were in response to assessment results from previous years which indicated that students needed a better understanding of unit conversion. Consultation with different nursing programs further confirmed the assessment results which motivated the change.

3. Course of action - After discussion of the results by the department, what course of action will the department take to improve student performance with respect to the assessed proficiency?

The department is encouraging participation in the numeracy project for instructors involved in CHE 125, 145 and 155.

For organic chemistry instructors who assess the class they are recommending that synthesis be introduced as early as possible in the first semester, and that use of synthesis be emphasize through the year.

PART 3: Additional Assessment and Contributions

Section 1: Please discuss activities that were supported by the assessment budget for the department assessment committee. In particular outline the department assessment committee activities for the academic year.

The chemistry department committee has met by teleconference to assign conveners for each of the classes assessed. The role of the convener is to implement and aid in the assessment process. Each convener meets with the instructors of the class and

develops tools and implements the rubrics that better fit the needs of the specific instructors. In order to make the assessment more effective..

In addition Professor Schatz and Gunasekera, meet over the summer to revise and propose changes for CHE 203.

Section 2: Please discuss activities that were supported by the assessment budget for overall department assessment activities. In particular outline the department assessment activities for the academic year.

The chemistry Department has met for the last three years during winter break to discuss assessment results and what changes should be taking place. Those meetings have allowed the department to refine the assessment tools, develop new tools, and discuss and implement changes in our teaching.

As a result of such exchanges we have revised courses such as CHE 125; which, was revised during the summer of 2005 and CHE 203, some of the members started revisions last summer.

Section 3: Please ask for and include in the report information from department members about any other assessment activities they have conducted, particularly in conjunction with grant-funded innovations. Also ask for and describe briefly any additional contributions to assessment such as publications, presentations, qualitative classroom innovations (**such as** Scholarship of Teaching and Learning activities), and other items relating to assessment that the department wishes to note.

Professors started a numeracy project designed to enhance the math abilities of our students. This project also includes contributions from the math department. The project is starting its second year, and includes a number of faculty teaching CHE 125, 145 and 155.

PART 4: Historical Trends

Section 1: History of General Education activities. Please add more rows as necessary. This should be an on-going list copied from each previous report.

Proficiency	Year Assessed	Results	Year Assessed	Results	Year Assessed	Results
A-1	2003 – 04 <i>Rubric was changed.</i>	E = 513 M = 431 F = 148		E = M = F =		E = M = F =
B-2	2004-2005	E = 659 M = 372 F = 56		E = M = F =		E = M = F =
A1	2005-2006 Revised Rubric	E = 464 M = 404 F = 82		E = M = F =		E = M = F =

Section 2: History of department learning objective activities. Please add more rows as necessary. This should be an on-going list copied from each previous report.

Objective	Year Assessed	Results	Year Assessed	Results	Year Assessed	Results
Analytical Skills	2003 – 04	E = 217 M = 326 F = 110	2005-06	E = 396 M = 477 F = 92		E = M = F =
Quantitative Skills 1	2004-2005	E = 164 M = 497 F = 299		E = M = F =		E = M = F =
Graphic Skills 2	2004-2005	E = 19 M = 22 F = 5		E = M = F =		E = M = F =