<table>
<thead>
<tr>
<th>Student Learning Outcome</th>
<th>Outcome Type</th>
<th>Methodology</th>
<th>n</th>
<th>History</th>
<th>Benchmark</th>
<th>Results</th>
<th>Strength of Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrate mastery of competencies from competency-based syllabus (CHE112)</td>
<td>Discipline/Program</td>
<td>Standardized exam (ACS exam)</td>
<td>65</td>
<td>9 years</td>
<td>Dept. average will meet or exceed national average</td>
<td>Dept average: 39.8 National average: 41.0</td>
<td>Neutral</td>
</tr>
<tr>
<td>2. Demonstrate ability to use chemical apparatus, instrumentation and equipment properly and safely and demonstrate ability to analyze data from a chemistry experiment (CHE111)</td>
<td>Discipline/Program</td>
<td>Lab Project</td>
<td>62</td>
<td>4 years</td>
<td>At least 50% of CHE111 students will determine their unknown acid concentration to within 1% and 75% will come within 4% of the true value.</td>
<td>45.2% of students determined their unknown acid concentration to within 1% of the true value; 85.5% came within 4% of the true value</td>
<td>Neutral</td>
</tr>
<tr>
<td>3. Demonstrate mastery of the approach and rationale of the scientific method and be able to apply these principles to solve problems. (CHE101)</td>
<td>SLO/GE</td>
<td>Rubric Graded Assignment</td>
<td>54</td>
<td>1 year</td>
<td>Students will average at least 75% on this rubric graded assignment.</td>
<td>Students averaged 90.3% on the rubric graded assignment</td>
<td>Strong</td>
</tr>
<tr>
<td>4. Demonstrate the ability to use critical thinking and quantitative reasoning to solve problems related to chemistry concepts.</td>
<td>SLO/GE</td>
<td>Pre-Post Test</td>
<td>113</td>
<td>2 years</td>
<td>There will be a statistically significant improvement in the percentage of students who successfully solve the problem.</td>
<td>Student success increased by 42.7%</td>
<td>Strong</td>
</tr>
<tr>
<td>5. Students who are prepared for CHE111 (based on a diagnostic exam) will successfully complete CHE111 (with a grade of “C” or better).</td>
<td>Other (retention)</td>
<td>Standardized exam and correlation with final grades</td>
<td>163</td>
<td>6 years</td>
<td>75% of students who are prepared for CHE111 (as predicted by their scores on the ACS Toledo test of basic skills) will complete CHE111 with a grade of “C” or better.</td>
<td>59% of prepared students successfully completed the course</td>
<td>Neutral</td>
</tr>
</tbody>
</table>
Program / Discipline Assessment Report

Program/Discipline: Chemistry Department
Responsibility: Kim Stasiewicz

Program/Discipline's Mission Statement:
The mission of the chemistry department, within the physical science department, is to provide learning-centered chemistry education to students. The chemistry department strives to educate traditional and non-traditional students who intend to pursue further educational or career opportunities about chemical principles in a dynamic, supportive, learning-centered environment. The chemistry department is committed to integrating appropriate technology, modern instrumentation, traditional and contemporary pedagogical approaches, and assessment of student achievement into classes in an attempt to create an environment that engages students in classroom activities that facilitate learning for students of all learning styles.

Program/Discipline's Assessment History:
By using the assessment process as an evaluative technique, how has it previously affected your program's curricula and/or teaching strategies?
We have adopted strategies for improving retention, such as trying supplemental instruction, assigning and grading homework, implementing online homework, and using college resources such as Early Alert.

By using the assessment process as an evaluative technique, what changes to student learning have been noted?
We don’t believe that any changes to student learning can be tied directly to the assessment process.

What unintended consequences, if any, have occurred because of the assessment process?
Since all sections of a course are included in assessment, the assessment process has encouraged us to look more closely at individual sections and instructors, and to begin to standardize student assessment in all sections.

Who receives information about your department's assessment and why? (Please note if you plan on altering either of these items for the coming year.)
All chemistry faculty (full time and part time) receive the information in order to improve the curriculum, improve teaching strategies, and enhance student learning in chemistry.

Part 1: Previous Academic Year Assessment Summary

Previous Academic Year: 2010-2011

Please duplicate or remove the tables on the following pages for each outcome you have assessed. If there are five outcomes in the last year, use/create five tables. (For your convenience, four tables have been generated, two Discipline/Program related and two Student Learning/General Education related.)

(To select an entire table, hover over part of the table; an icon should appear with four arrows in the table’s upper-left corner ... click on it. You can also drag over all the cells of the table to select it.) Once selected, choose Edit>Copy, click in the space immediately following the table, and choose Edit>Paste.
<table>
<thead>
<tr>
<th>Outcome #: 1</th>
<th>Outcome Title: CHE112 Content Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Type</strong> (choose one):</td>
<td><strong>Outcome Description:</strong> Students will demonstrate mastery of competencies identified on the competency-based syllabus for second semester general college chemistry, CHE112.</td>
</tr>
<tr>
<td>X Discipline/Program  ☑SLO/GE  ☐Other</td>
<td></td>
</tr>
<tr>
<td><strong>Benchmark for success</strong></td>
<td>1) The department average for all students taking CHE112 (second semester general college chemistry) should be at or above the national average (41 out of 70) on the American Chemical Society (ACS) standardized exam. 2) The ACS exam is a nationally accepted measure of student understanding in chemistry. Students are required to understand concepts and solve quantitative problems in order to succeed on this exam. If students can perform well on the ACS exam, they are prepared for future chemistry courses as they transfer to four year schools.</td>
</tr>
<tr>
<td>1) Please specify what percentage of the sample size is expected to meet or exceed your benchmark. 2) What is the rationale for choosing this measure?</td>
<td></td>
</tr>
<tr>
<td><strong>Description of assessment process:</strong></td>
<td>1) National standardized test (ACS exam) 2) Scoring at or above the national average on this exam ensures that students are prepared for future science classes. They must understand concepts and solve quantitative problems to be successful. 3) This outcome is measured yearly; data is collected in fall, spring, and summer semesters to maximize sample size. 4) This year, 65 students took the ACS exam.</td>
</tr>
<tr>
<td>1) What assessment methods were used to measure this outcome (i.e. pre/post test, portfolio review, etc.)? 2) How do these methods show students are learning? 3) What frequency is this outcome being measured (i.e.: each semester, yearly, every other year, etc.) and why? 4) How many students made up the sample size?</td>
<td></td>
</tr>
<tr>
<td><strong>Results</strong> What were the results of the assessment process? (List results for each method, if more than one were used.)</td>
<td>The department average on the ACS exam was 39.8 out of 70.</td>
</tr>
<tr>
<td><strong>What did the department learn?</strong> 1) How did group performance compare to the benchmark? 2) How does the data compare to the previous year, if applicable? 3) If multiple measures were used, how do they compare to each other?</td>
<td>1) The department narrowly missed the benchmark. The department average was 39.8; the national average (benchmark) was 41.0. 2) This result is just slightly worse than last year’s average. (See chart below for historical data.)</td>
</tr>
</tbody>
</table>
Student performance summary
1) Based on the findings, how does the department rate student performance in regards to this outcome (strong, weak, or neutral)?
2) How does this assessment affect plans for this coming year in terms of curricula, teaching strategies, and assessment methods?

1) Based on the results of the ACS exam, the department rates student performance as neutral. The benchmark of scoring at or above the national average was just narrowly missed.
2) This assessment does not change current curriculum, teaching strategies, or assessment methods. We continue to strive to help students master the content required for a second semester chemistry class, and not “teach to the exam.” The ACS exam will be given in future semesters and the results will continue to be tracked to ensure that we are achieving this goal.
**Outcome #:** 2  

**Outcome Type (choose one):**  
X Discipline/Program ☐ SLO/GE ☐ Other  

**Outcome Title:** CHE111 Laboratory Technique  

**Outcome Description:**  
Students in CHE111 will demonstrate the ability to use chemical apparatus, instrumentation and equipment properly and safely.

---

**Benchmark for success**  
1) Please specify what percentage of the sample size is expected to meet or exceed your benchmark.  
2) What is the rationale for choosing this measure?  

1) At least 50% of CHE111 students will determine their unknown acid concentration to within 1%. At least 75% of CHE111 students will determine their unknown acid concentrations to within 4%.  
2) The benchmark was met last year. It is expected that students in CHE111 should have the lab skills needed to achieve this level of accuracy.

---

**Description of assessment process:**  
1) What assessment methods were used to measure this outcome (i.e. pre/post test, portfolio review)?  
2) How do these methods show students are learning?  
3) What frequency is this outcome being measured (i.e.: each semester, yearly, every other year, etc.) and why?  
4) How many students made up the sample size?  

1) This assessment is a practical demonstration of students’ lab abilities, given at approximately the midpoint of the first semester of general chemistry. Students first standardize a solution of sodium hydroxide by titrating it with a standard KHP solution which they prepare. Then, they use the standardized sodium hydroxide solution to determine the concentration of an unknown acid solution, using acid-base titration techniques.  
2) In order for students to succeed at this task, they must have mastered the skills of acid-base titration (involving the use of many laboratory techniques such as proper weighing, pipeting, and buret reading). They must also understand and be able to apply the critical thinking and problem-solving skills that are needed to analyze their results and calculate the concentration of the unknown.  
3) This outcome is measured yearly. Data is collected in the fall and spring semesters.  
4) The sample size was 62 students.

---

**Results**  
What were the results of the assessment process? (List results for each method, if more than one were used.)  

Twenty-eight out of the sixty-two students (45.2% of students) determined the unknown acid concentration to within 1%. Fifty-three students (85.5%) determined the concentration to within 4%.
### What did the department learn?
1) How did group performance compare to the benchmark?
2) How does the data compare to the previous year, if applicable?
3) If multiple measures were used, how do they compare to each other?

1) The first benchmark was not met; we were 4.8% lower than we had hoped. However, the second benchmark was exceeded (85.5% compared to the benchmark of 75%).
2) Although fewer students are coming within 1% of the true value, more are managing to come close to it (within 2% or 3%). The percentage of students who were far from the correct value continues to be large.
3) N/A

### Student performance summary
1) Based on the findings, how does the department rate student performance in regards to this outcome (strong, weak, or neutral)?
2) How does this assessment affect plans for this coming year in terms of curricula, teaching strategies, and assessment methods?

1) The department rates the overall performance as neutral. One benchmark was narrowly missed and the second was exceeded.
2) Despite the fact that most students performed well on this assessment (came within 4% of the true value), a large group of students still did not come anywhere close to the benchmark. (See graph)

There are large variations in success on this outcome from section to section (instructor to instructor). This indicates that perhaps instructor training in this task would be beneficial.
<table>
<thead>
<tr>
<th><strong>Outcome #</strong>: 3</th>
<th><strong>Outcome Title</strong>: Scientific Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Type</strong> (choose one):</td>
<td><strong>Outcome Description</strong>: A student will demonstrate mastery of the approach and rationale of the scientific method and be able to apply these principles to solve problems.</td>
</tr>
<tr>
<td>- Discipline/Program</td>
<td>- SLO/GE</td>
</tr>
<tr>
<td>If Student Learning Outcome/General Education (choose one):</td>
<td></td>
</tr>
<tr>
<td>- Society and Culture/Diversity and Global Awareness</td>
<td>- Problem Solving/Critical Thinking</td>
</tr>
<tr>
<td>- Communication</td>
<td>- Quantitative Reasoning</td>
</tr>
<tr>
<td>Technology</td>
<td>- Interpersonal Skills/Leadership and Teamwork</td>
</tr>
<tr>
<td>Ethics</td>
<td>- Aesthetics</td>
</tr>
<tr>
<td>- Information Management</td>
<td>- Personal Development and Responsibility</td>
</tr>
</tbody>
</table>

| **Benchmark for success** | 1) Please specify what percentage of the sample size is expected to meet or exceed your benchmark.  
2) What is the rationale for choosing this measure? |
|----------------|--------------------------------------|
| 1) Students will average at least 75% on this rubric-graded assessment.  
2) This is the first year that this assessment has been given. The benchmark of 75% seems like a reasonable starting point based on the difficulty of the assignment. |

| **Description of assessment process:** | 1) What assessment methods were used to measure this outcome (i.e. pre/post test, portfolio review)?  
2) How do these methods show students are learning?  
3) What frequency is this outcome being measured (i.e.: each semester, yearly, every other year, etc.) and why?  
4) How many students made up the sample size? |
|----------------------------------|--------------------------------------|
| 1) This is a rubric-graded assignment.  
2) In order for students to succeed at this assignment, they must apply the scientific method to an everyday problem. They must clearly state the problem, form and test a hypothesis, collect data, analyze results, and draw a conclusion.  
3) This outcome was measured in the spring semester.  
4) There were 54 students participating in this assessment. |

<table>
<thead>
<tr>
<th><strong>Results</strong></th>
<th>For this assessment, the average student score was 7.22 out of 8, or 90.3% according to the grading rubric.</th>
</tr>
</thead>
</table>

| **What did the department learn?** | 1) The benchmark was exceeded.  
2) N/A  
3) N/A |
|----------------------------------|--------------------------------------|

| **Student performance summary** | 1) The department rates student performance as strong.  
2) The department will measure this outcome for another year in order to make comparisons. We will attempt to standardize the assignment across all sections and all instructors. |
|----------------------------------|--------------------------------------|

1) Based on the findings, how does the department rate student performance in regards to this outcome (strong, weak, or neutral)?  
2) How does this assessment affect plans for this coming year in terms of curricula, teaching strategies, and assessment methods?
<table>
<thead>
<tr>
<th><strong>Outcome #</strong>: 4</th>
<th><strong>Outcome Title</strong>: CHE111 Density Problem</th>
</tr>
</thead>
</table>
| **Outcome Type** *(choose one)*:  
[ ] Discipline/Program  [x] SLO/GE  [ ] Other  
*If Student Learning Outcome/General Education (choose one):  
[ ] Communication  [ ] Society and Culture/Diversity and Global Awareness  [x] Problem Solving/Critical Thinking  [ ] Quantitative Reasoning  [ ] Technology  [ ] Interpersonal Skills/Leadership and Teamwork  [ ] Aesthetics  [ ] Values and Ethics  [ ] Information Management  [ ] Personal Development and Responsibility* | **Outcome Description**:  
Students will demonstrate the ability to use critical thinking and quantitative reasoning to solve problems related to chemistry concepts. |

**Benchmark for success**  
1) Please specify what percentage of the sample size is expected to meet or exceed your benchmark.  
2) What is the rationale for choosing this measure?  

1) Students will show at least a 30% improvement from the beginning of the semester to the end.  
2) A 30% improvement indicates that students have mastered this typical word problem during the course of the semester.

**Description of assessment process**:  
1) What assessment methods were used to measure this outcome (i.e. pre/post test, portfolio review, etc.)?  
2) How do these methods show students are learning?  
3) What frequency is this outcome being measured (i.e.: each semester, yearly, every other year, etc.) and why?  
4) How many students made up the sample size?  

1) **Pre/post test**:  
   Students were given a word problem asking them to determine the volume of a sample, given its density and mass. The question was given during the first week of the semester, and then again during the last few weeks of the semester.  
   2) **Students must use critical thinking, problem solving skills, and quantitative reasoning to correctly determine the volume of a sample, given its mass and density.**  
   3) **The outcome is being measured each semester. This provides the largest possible sample size and provides a sample that represents almost all CHE111 students. (This outcome is not measured in the summer due to time constraints.)**  
   4) **There were 113 students who took the pretest. Only 38 students participated in the posttest (there was an error made and the posttest was not given in all sections.)**

**Results**  
What were the results of the assessment process? (List results for each method, if more than one were used.)  
For the pretest, 25.7% of students answered the question correctly.  
For the posttests, 68.4% of students answered correctly.  
This is an improvement of 42.7%.

**What did the department learn?**  
1) How did group performance compare to the benchmark?  
2) How does the data compare to the previous year, if applicable?  
3) If multiple measures were used, how do they compare to each other?  

1) **The benchmark was met.**  
2) **Last year’s improvement was 34.5%; this year’s results are better by 8.2%.**  
3) **N/A**

**Student performance summary**  
1) Based on the findings, how does the department rate student performance in regards to this outcome (strong, weak, or neutral)?  
2) How does this assessment affect plans for this coming  

1) **The department rates student performance as strong.**  
2) **We plan to continue this assessment, and to compare future results with those obtained here.**
Outcome #:  5

**Outcome Title:** CHE111 retention

**Outcome Type** (choose one):
- X Discipline/Program
- SLO/GE
- Other

If **Student Learning Outcome/General Education** (choose one):
- Communication
- Society and Culture/Diversity and Global Awareness
- Problem Solving/Critical Thinking
- Quantitative Reasoning
- Technology
- Interpersonal Skills/Leadership and Teamwork
- Aesthetics
- Values and Ethics
- Information Management
- Personal Development and Responsibility

**Outcome Description:**
Students who are prepared for CHE111 (based on a diagnostic exam) will successfully complete CHE111 (with a grade of “C” or better).

**Benchmark for success**
1) Please specify what percentage of the sample size is expected to meet or exceed your benchmark.
2) What is the rationale for choosing this measure?

| 1) 75% of students who are prepared for CHE111 (as predicted by their scores on the ACS Toledo test of basic skills) will complete CHE111 with a grade of “C” or better. |
| 2) This is the sixth year that this test has been used as part of the chemistry assessment, and it is intended to track trends in student and department performance and retention. |

**Description of assessment process:**
1) What assessment methods were used to measure this outcome (i.e. pre/post test, portfolio review, etc.)?
2) How do these methods show students are learning?
3) What frequency is this outcome being measured (i.e.: each semester, yearly, every other year, etc.) and why?
4) How many students made up the sample size?

| 1) Standardized diagnostic exam (ACS Toledo test of basic skills) and correlation with final grades. |
| 2) The grades on this exam are correlated with final grades in CHE111 to track retention and student success in the course. We compare the number of students who SHOULD be able to successfully complete the course (based on this diagnostic exam) with the number of students who actually DO successfully complete it (with a “C” or better). |
| 3) This outcome is measured yearly; data is collected in fall and spring semesters to maximize sample size. |
| 4) This year, we have data from 164 students. |

**Results**
What were the results of the assessment process? (List results for each method, if more than one were used.)

| Overall, 163 students were well prepared or moderately well prepared when they entered CHE111. Of those 163 students, a total of 96 successfully completed CHE111 (with a grade of “C” or better). The other 67 students either dropped the course or earned a grade of “D” or “F”. |
| Specifically, 58.9% of prepared students completed the course successfully; 31.9% of prepared students dropped the course; and 9.8% of prepared students earned a grade of “D” or “F”. |

The following flowchart summarizes the results of students taking the ACS Toledo diagnostic exam, and their subsequent performance in CHE111:
What did the department learn?
1) How did group performance compare to the benchmark?
2) How does the data compare to the previous year, if applicable?
3) If multiple measures were used, how do they compare to each other?

1) The benchmark was not met; only 59% of students who were prepared to take CHE111 (as predicted by their diagnostic test scores) actually completed the course with a “C” or better. The benchmark is 75%.
2) Last year, 63% of prepared students successfully completed CHE111.
3) N/A

Student performance summary
1) Based on the findings, how does the department rate student performance in regards to this outcome (strong, weak, or neutral)?
2) How does this assessment affect plans for this coming year in terms of curricula, teaching strategies, and assessment methods?

1) The department rates student performance as neutral. Although the benchmark was not met, the percentage of students actually earning grades of “D” or “F” was small (9.8%). The other unsuccessful students dropped the course.
2) This outcome will continue to be assessed, in order to track trends in student retention and success. We will attempt to collect data on why students are not successful, in line with the college’s efforts to improve rates of retention and completion. In future assessments, we will begin to track students who withdraw by the census date, and we will not count those students in our data. Previous assessments have counted these students as unsuccessful, which is not the case. And finally, we are attempting to find data on the national retention rates for first semester general chemistry courses, in order to compare our retention rates with others across the country.
Part 2: Current Academic Year Assessment Plan

- Your program may wish to examine how retention differs among sections of an important course or you may choose to do an analysis of grade inflation across courses within your program/discipline. Such items aren't truly student outcomes, but they certainly affect learning. As such, these outcomes will be classified as "Other" in the summary you create next year. (Measuring such outcomes is purely optional.)
- Two or more instruments of measuring an objective may provide greater clarity and validity, but only one is required. The department or program makes the decision. The Program Assessment committee and deans are available for consultation.
- In the past, some programs have been identified purely by prefix or in some cases by the type of section offered. Sometimes, a very limited pool of students have been available for such a program to assess, or the program lacks full-time faculty to plan, assess, and report outcomes. If your program has such difficulties, please contact either the Program Assessment committee's chair or your School's Program Assessment committee representative. We will work with you to find a solution.
- CTE programs with external accreditation may use the accreditation report to in addition or in lieu of these forms, please contact the Program Assessment committee representative if this format is desired. In absence of this contact, these forms are expected.
- Outcomes are to be measured annually. Exceptions are made with VPI approval for outcomes that clearly need a less (or more) frequent review.

Outcome minimums

- At least two outcomes are to be program/discipline-related.
- At least two outcomes are to be General Education in nature. One General Education outcome must be continued from the prior year to develop a historical trend. General Education outcomes need to be assessed and reported annually, regardless of the frequency of reporting for other outcomes.
- Both outcomes above are classified as "student learning" outcomes, requiring benchmarks and analysis. It is strongly recommended that you use the table provided in Part 1 of this report for this function. Definitions and examples of these outcomes are provided in Appendix A at the end of this document. Your Program Assessment committee is available to assist.
- An assessment report is requested annually. Such a report may only consist of a report on General Education outcomes and a plan summarizing where your program is in an assessment with multi-year frequency.
Current Academic Year: 2011-2012

Intended Learning Outcomes (only include if they differ from those noted in Part 1)

Assessment Method(s) (only include if they differ from those noted in Part 1)

Benchmarks (only include if they differ from those noted in Part 1)

For outcome #2 (CHE111 Lab Technique), the benchmark will be “At least 50% of students will determine their %KHP to within 1% of the true value, and at least 75% will come within 2% of the true value.”

Have you submitted a separate budget worksheet? (Choose by bolding; for information about this worksheet, please refer to the specific budgeting e-mail sent by the committee chairperson.)

Yes  No

Please submit this report (including both last year's summary and this year's plan) in a Word document to the Program Assessment committee chairperson (Cheyne Bamford: cheyne.bamford@arapahoe.edu). If you have any questions about the process, please contact the chairperson.