

Course Student Learning Outcomes Assessment

CHEM 219 General Chemistry

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General Information (Course Student Learning Outcomes Assessment)

Standing Requirements

Course Description

Fundamental principles and concepts of chemistry including but not limited to atomic structure quantum theory periodic properties stoichiometry oxidation-reduction molecular structure and bonding gas laws states of matter solutions chemical kinetics and chemical equilibrium.

Course Student Learning Outcomes

CHEM 219 General Chemistry Outcome Set

Outcome	
Outcome	Mapping
Outcome 1 Identify the essential parts of a problem and apply known chemical concepts in solving the problem.	Institutional Student Learning Outcomes: Act 1, Communicate 1, Communicate 2, Learn 1, Think 1, Think 2
Outcome 2 Write in scientific terms and explain observed scientific phenomenon using the language of Chemistry.	Institutional Student Learning Outcomes: Act 1, Communicate 1, Communicate 2, Learn 1, Think 1, Think 2
Outcome 3 Perform experiments with given the directions, collect valid scientific data, analyze the data and interpret laboratory results.	Institutional Student Learning Outcomes: Act 1, Communicate 1, Communicate 2, Learn 1, Think 1, Think 2

2014-2015 Assessment Cycle

Measurements

Outcomes and Measures

CHEM 219 General Chemistry Outcome Set

Outcome

Outcome 1

Identify the essential parts of a problem and apply known chemical concepts in solving the problem.

▼ **Measure:** Chem 219 SLO 1 (Lecture)
Course level; Direct - Exam

Description of Measurement Tool: We used a common final exam as 25 multiple choice questions to give to all four sections assessed. The exam had some concept questions and some calculation based problems.

Criteria for Success: Individual & Collective Student Criterion: A successful student must score 60% or higher correct on the common multiple choice questions. The SLO is achieved when a minimum of 70% of the students taking the course are successful in achieving the outcome.

Cycle of Assessment: This outcome is assessed during each Fall semester.

Who is Responsible for Assessment Activity?: The instructor of record is responsible for administering the assessment. The "lead instructor" for the course is responsible for compiling the data and sharing results with the department. The "lead instructor" for Chem 219 in Fall 2014 was Jeffrey Wada

Outcome 2

Write in scientific terms and explain observed scientific phenomenon using the language of Chemistry.

▼ **Measure:** Chem 219 SLO 2 & 3 (Lab)
Course level; Direct - Other

Description of Measurement Tool: As a method of assessment, we used laboratory reports as a way to assess both SLOs 2 & 3. A full laboratory report of Experiment #10 (Determination of the Concentration of Vinegar and the Molar Mass of an Unknown) is used to assess these SLOs.

The students are asked to perform the volumetric analysis experiment over 3 laboratory periods. Directions to perform the experiment are given in the laboratory manual. The students are evaluated on their ability to follow procedure, collect their data and perform the necessary calculations

A rubric is used to standardize grading of the lab report and help identify the features we are looking for in students' performance.

Level of Achievement on a section = score

Missing = 0

Beginning = 1

Competent = 2

Accomplished = 3

There are 7 sections graded.

Criteria for Success: Individual & Collective Student Criterion: Success is achieved when at least 70% of the students earn a competent or accomplished score on the overall lab report (14 or above out of 21 possible points).

Cycle of Assessment: These SLOs are assessed every Fall semester.

Who is Responsible for Assessment Activity?: The instructor of record is responsible for administering the assessment. The Lead Instructor for the course is responsible for compiling the data and sharing results with the department. The Lead Instructor for Chem 219 in Fall 2014 was Jeffrey Wada

Outcome 3

Perform experiments with given the directions, collect valid scientific data, analyze the data and interpret laboratory results.

▼ **Measure:** Chem 219 SLO 2 & 3 (Lab)
Course level; Direct - Other

Description of Measurement Tool: As a method of assessment, we used laboratory reports as a way to assess both SLOs 2 & 3. A full laboratory report of Experiment #10 (Determination of the Concentration of Vinegar and the Molar Mass of an Unknown) is used to assess these SLOs.

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 **Findings**
Finding per Measure**CHEM 219 General Chemistry Outcome Set****Outcome****Outcome 1**

Identify the essential parts of a problem and apply known chemical concepts in solving the problem.

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Findings for Chem 219 SLO 1 (Lecture)

Summary of Findings: Number of students assessed: 86

Number of sections: 4

Average correct answers for each instructor: 15.3 (61.2%), 14.17 (56.7%), 14.86 (59.44%),

Average correct answers for all sections combined: 14.9 (59.60%)

45 (52.3%) of the students scored at least 60% correct on the assessment

Results: Criteria for Success Achievement Status: Not Met

Analysis of Findings: Summary of Findings: Number of students assesses: 70

Number of sections: 3

Average correct answers for each instructor: 15.83 (63.3%), 14.55 (58.2%)

Average answers for all sections combined: 15.37 (61.5%)

52 (74.3%) of the students scored at least 60% correct on the assessment

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: From the data, these questions had a low correctness (less than 50%).

Question #10 (Molecular geometry) 46.51% correct

Question #16 (Bonding:Molecular polarity) 43.02% correct

Question #19 (Attractive Forces:Ordering substances in order of mp) 34.88% correct

Question #20 (Colligative Properties: Freezing point depression) 24.42% correct

Question #22 (Atomic Structure: Ionic radius) 33.72% corrects

Question #23 (Phases of Matter) 31.40%

Question #24 (Phases of Matter) 48.84%

Unlike the previous years assessment (before 2011), the poor scoring questions seem to be more evenly distributed throughout the exam. By changing the length of the assessment, test fatigue has been minimized. But there is still a factor of fatigue because of the low percentage correct for questions 19, 20, 22, 23, & 24.

There were 7 questions(10, 16, 19, 20, 22, 23, & 24) that had low correct response rates(less than 50%). The number of students getting these questions correct has decrease from the previous year by a small amount.

Question #10 is difficult for many students because they rely often on models. The students were not allowed to used models on the exam. They needed to visualize the molecules as three dimensional particles.

Question #16 is often a problem for students due to the fact the question involves so many concepts (Lewis structures, VSEPR, bonding polarity, & molecular polarity). If one mistake in any of these concepts is made by the student, their answer will lead to an incorrect answer.

Question #19 is an extension of Question #16 with an addition of a few concepts (intermolecular attractions and physical properties). Any mistake made by any of the concepts leads to an incorrect answer.

The other poor scoring questions (20,22, 23, & 24), is hard to guess what students are misinterpreting. To get a better understanding of the students' "disconnect" and analysis must be made of what the students answered incorrectly with.

Recommendations: We will continue to use the same assessment tool in Fall 2015.

To get a better understanding of the students' "disconnect" and analysis must be made of what the students answered incorrectly with.

This year analysis finds that in


Question #10 the students are choosing the most selected wrong answer because of the subscript

Question #19 the students are choosing the most selected wrong answer because they do not recognize hydrogen bonding

Question #20 the students are choosing the most selected wrong answer because they do not recognize the ionization factor(i)

Other answers for the low scoring questions show random guessing.

Substantiating Evidence:

 Item Analysis MCQ SLO Chem 219 F2014.csv (File) (See appendix)

Outcome 2

Write in scientific terms and explain observed scientific phenomenon using the language of Chemistry.

▼ **Measure:** Chem 219 SLO 2 & 3 (Lab)
Course level; Direct - Other

Description of Measurement Tool: As a method of assessment, we used laboratory reports as a way to assess both SLOs 2 & 3. A full laboratory report of Experiment #10 (Determination of the

Concentration of Vinegar and the Molar Mass of an Unknown) is used to assess these SLOs.

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Findings for Chem 219 SLO 2 & 3 (Lab)

Summary of Findings: Number of students assessed: 85
Number of sections: 4

(see attachment SLO 2 & 3 Chem 219 Findings)

81 (95.29%) of the students earned competent or accomplished on the assessment.

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: The lowest scoring portion of the assessment was the determination of the molar mass of the unknown acid. This leads to a very confusing result. In previous years, the Molar Mass results were higher than the Acetic Acid % results. This was contributed to the fact that by the time the student performed the Molar Mass of the Unknown Acid, they had a much stronger grasp on the concepts being tested and better technique in titration. But this year, the results are backwards. No explanation can be made.

Students were quite strong in presenting data and calculations in a clear and logical manner.

Recommendations: We will continue using this assessment for SLOs 2 & 3.

Discuss separating out the different sections of the assessment for SLOs 2 & 3. Example: Purpose, Procedure, and Conclusion for SLO 2. Data & Results, Calculations, Accuracy (% and molar mass) for SLO 3.

Substantiating Evidence:

 219SLOEXPTF2014.xlsx (Excel Workbook (Open XML)) (See appendix)

Outcome 3

Perform experiments with given the directions, collect valid scientific data, analyze the data and interpret laboratory results.

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Substantiating Evidence:

 219SLOEXPTF2014.xlsx (Excel Workbook (Open XML)) (See appendix)

Overall Recommendations

No text specified

 **Plans of Action**

 **Status Reports**

2013-2014 Assessment Cycle

Measurements

Outcomes and Measures

CHEM 219 General Chemistry Outcome Set

Outcome

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 **Findings**
Finding per Measure**CHEM 219 General Chemistry Outcome Set****Outcome****Outcome 1**

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Findings for Chem 219 SLO 1 (Lecture)

Summary of Findings: Number of students assessed: 70

Number of sections: 3

Average correct answers for each instructor: 15.83 (63.3%), 14.55 (58.2%)

Average answers for all sections combined: 15.37 (61.5%)

52 (74.3%) of the students scored at least 60% correct on the assessment

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: From the data, these questions had a low correctness (less than 50%).

Question #10 (Molecular geometry) 45.3% correct

Question #16 (Bonding:Molecular polarity) 44.3% correct

Question #19 (Attractive Forces:Ordering substances in order of mp) 30.0% correct

Question #20 (Colligative Properties: Freezing point depression) 34.3% correct

Question #22 (Atomic Structure: Ionic radius) 37.1% corrects

Question #23 (Phases of Matter) 31.4%

Unlike the previous years assessment (before 2011), the poor scoring questions seem to be evenly distributed throughout the exam. By changing the length of the assessment, test fatigue has been minimized.

There were 6 questions(10, 16, 19, 20, 22, & 23) that had low correct response rates(less than 50%). Even though these questions did not show high success, the scores did improve from the previous year. An improvement is being made.

Question #10 is difficult for many students because they rely often on models. The students were not allowed to use models on the exam. They needed to visualize the molecules as three dimensional particles.

Question #16 is often a problem for students due to the fact the question involves so many concepts (Lewis structures, VSEPR, bonding polarity, & molecular polarity). If one mistake in any of these concepts is made by the student, their answer will lead to an incorrect answer.

Question #19 is an extension of Question #16 with an addition of a few concepts (intermolecular attractions and physical properties). Any mistake made by any of the concepts leads to an incorrect answer.

The other poor scoring questions (20,22, & 23), is hard to guess what students are misinterpreting. To get a better understanding of the students' "disconnect" and analysis must be made of what the students answered incorrectly with.

Recommendations: We will continue to use the same assessment tool in Fall 2014.

To get a better understanding of the students' "disconnect" and analysis must be made of what the students answered incorrectly with.

Outcome 2

Write in scientific terms and explain observed scientific phenomenon using the language of Chemistry.

▼ Measure: Chem 219 SLO 2 & 3 (Lab)

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Findings for Chem 219 SLO 2 & 3 (Lab)

Summary of Findings: Number of students assessed: 90
Number of sections: 4

(see attachment SLO 2 & 3 Chem 219 Findings)

85 (94.4%) of the students earned competent or accomplished on the assessment.

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: The lowest scoring portion of the assessment was the determination of the molar mass of the unknown acid. This leads to a very confusing result. In previous years, the Molar Mass results were higher than the Acetic Acid % results. This was contributed to the fact that by the time the student performed the Molar Mass of the Unknown Acid, they had a much stronger grasp on the concepts being tested and better technique in titration. But this year, the results are backwards. No explanation can be made.


There was a slight increase in the average score in this year's conclusions(2.41) from the previous years conclusion (lowest scoring section) of 2.31. No conclusions can be made about the slight increase in this score.

Students were quite strong in presenting data and calculations in a clear and logical manner.

Recommendations: We will continue using this assessment for SLOs 2 & 3.

Discuss separating out the different sections of the assessment for SLOs 2 & 3. Example: Purpose, Procedure, and Conclusion for SLO 2. Data & Results, Calculations, Accuracy (% and molar mass) for SLO 3.

Substantiating Evidence:

 SLO 2 & 3 Chem 219 Findings (Adobe Acrobat Document) (See appendix)

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Substantiating Evidence:

 SLO 2 & 3 Chem 219 Findings.pdf (Adobe Acrobat Document) (See appendix)

Overall Recommendations

No text specified

Plans of Action

Actions

CHEM 219 General Chemistry Outcome Set

Outcome

Outcome 1

No actions specified

Identify the essential parts of a problem and apply known chemical concepts in solving the problem.

Status Reports

Action Statuses

CHEM 219 General Chemistry Outcome Set

Outcome

Outcome 1

No actions specified

Identify the essential parts of a problem and apply known chemical concepts in solving the problem.

Status Summary

No text specified

Summary of Next Steps

No text specified

2012-2013 Assessment Cycle

Measurements

Outcomes and Measures

CHEM 219 General Chemistry Outcome Set

Outcome

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 **Findings**
Finding per Measure**CHEM 219 General Chemistry Outcome Set****Outcome****Outcome 1**

Identify the essential parts of a problem and apply known chemical concepts in solving the problem.

▼ **Measure:** Chem 219 SLO 1 (Lecture)
Course level; Direct - Exam

Description of Measurement Tool: We used a common final exam as 25 multiple choice questions to give to all sections assessed. The exam had some concept questions and some calculation based problems.

Criteria for Success: Individual & Collective Student Criterion: A successful student must score 60% or higher correct on the common multiple choice questions. The SLO is achieved when a minimum of 70% of the students taking to course are successful n achieving the outcome.

Cycle of Assessment: This outcome is assessed during each Fall semester.

Who is Responsible for Assessment Activity?: The instructor of record is responsible for administering the assessment. The Lead Instructor for the course is responsible for compiling the data and sharing results with the department. The Lead Instructor for Chem 219 in Fall 2013 was Jeffrey Wada.

Findings for Chem 219 SLO 1 (Lecture)

Summary of Findings: Number of students assesses: 70

Number of sections: 3

Average correct answers for each instructor: 15.83 (63.3%), 14.55 (58.2%)

Average answers for all sections combined: 15.37 (61.5%)

52 (74.3%) of the students scored at least 60% correct on the assessment.

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: From the data, these questions had a low correctness (less than 50%).

Question #10 (Molecular geometry) 45.3% correct

Question #16 (Bonding:Molecular polarity) 44.3% correct

Question #19 (Attractive Forces:Ordering substances in order of mp) 30.0% correct

Question #20 (Colligative Properties: Freezing point depression) 34.3% correct

Question #22 (Atomic Structure: Ionic radius) 37.1% corrects

Question #23 (Phases of Matter) 31.4%

Unlike the previous years assessment (before 2011), the poor scoring questions seem to be evenly distributed throughout the exam. By changing the length of the assessment, test fatigue has been minimized.

There were 6 questions(10, 16, 19, 20, 22, & 23) that had low correct response rates(less than 50%). Even though these questions did not show high success, the scores did improve from the previous year. An improvement is being made.

Question #10 is difficult for many students because they rely often on models. The students were not allowed to use models on the exam. They needed to visualize the molecules as three dimensional particles.

Question #16 is often a problem for students due to the fact the question involves so many concepts (Lewis structures, VSEPR, bonding polarity, & molecular polarity). If one mistake in any of these concepts is made by the student, their answer will lead to an incorrect answer.

Question #19 is an extension of Question #16 with an addition of a few concepts (intermolecular attractions and physical properties). Any mistake made by any of the concepts leads to an incorrect answer.

The other poor scoring questions (20,22, & 23), is hard to guess what students are misinterpreting. To get a better understanding of the students' "disconnect" and analysis must be made of what the students answered incorrectly with.

Recommendations: We will continue to use the same assessment tool in Fall 2014.

Outcome 2

Write in scientific terms and explain observed scientific phenomenon using the language of Chemistry.

▼ Measure: Chem 219 SLO 2 & 3 (Lab)

Course level; Direct - Other

Description of Measurement Tool: As a method of assessment, we used laboratory reports as a way to assess both SLOs 2 & 3. A full laboratory report of Experiment #9 (Determination of the Concentration of Vinegar and the Molar Mass of an Unknown) is used to assess these SLOs.

The students are asked to perform the volumetric analysis experiment over 3 laboratory periods. Directions to perform the experiment are given in the laboratory manual. The students are evaluated on their ability to follow procedure, collect their data and perform the necessary calculations

A rubric is used to standardize grading of the lab report and help identify the features we are looking for in students' performance.

Level of Achievement on a section = score

Missing = 0

Beginning = 1

Competent = 2

Accomplished = 3

There are 7 sections graded.

Criteria for Success: Individual & Collective Student Criterion: Success is achieved when at least 70% of the students earn a competent or accomplished score on the overall lab report (14 or above out of 21 possible points).

Cycle of Assessment: These SLOs are assessed every Fall semester.

Who is Responsible for Assessment Activity?: The instructor of record is responsible for administering the assessment. The Lead Instructor for the course is responsible for compiling the

data and sharing results with the department. The Lead Instructor for Chem 219 in Fall 2013 was Jeffrey Wada

Findings for Chem 219 SLO 2 & 3 (Lab)

Summary of Findings: Number of students assessed: 90
Number of sections: 4

(see attached table for individual section achievement analysis)

85 (94.4%) of the students earned competent or accomplished on the assessment.

Results: Criteria for Success Achievement Status: Exceeded

Analysis of Findings: The lowest scoring portion of the assessment was the determination of the molar mass of the unknown acid. This leads to a very confusing result. In previous years, the Molar Mass results were higher than the Acetic Acid % results. This was contributed to the fact that by the time the student performed the Molar Mass of the Unknown Acid, they had a much stronger grasp on the concepts being tested and better technique in titration. But this year, the results are backwards. No explanation can be made.


There was a slight increase in the average score in this year's conclusions(2.41) from the previous years conclusion (lowest scoring section) of 2.31. No conclusions can be made about the slight increase in this score.

Students were quite strong in presenting data and calculations in a clear and logical manner.

Recommendations: We will continue using this assessment for SLOs 2 & 3.

Discuss separating out the different sections of the assessment for SLOs 2 & 3. Example: Purpose, Procedure, and Conclusion for SLO 2. Data & Results, Calculations, Accuracy (% and molar mass) for SLO 3.

Substantiating Evidence:

 Chem 219 Lab SLO Analysis Fall 2013 (Word Document (Open XML)) (See appendix)

Outcome 3

Perform experiments with given the directions, collect valid scientific data, analyze the data and interpret laboratory results.

▼ **Measure:** Chem 219 SLO 2 & 3 (Lab)
Course level; Direct - Other

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The students are asked to perform the volumetric analysis experiment over 3 laboratory periods. Directions to perform the experiment are given in the laboratory manual. The students are evaluated on their ability to follow procedure, collect their data and perform the necessary calculations

A rubric is used to standardize grading of the lab report and help identify the features we are looking for in students' performance.

Level of Achievement on a section = score

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Competent = 2

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There are 7 sections graded.

Criteria for Success: Individual & Collective Student Criterion: Success is achieved when at least 70% of the students earn a competent or accomplished score on the overall lab report (14 or above out of 21 possible points).

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Substantiating Evidence:

 Chem 219 Lab SLO Analysis (Word Document (Open XML)) (See appendix)

Overall Recommendations

No text specified

 **Plans of Action**

 **Status Reports**

Appendix

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- A. **219SLOEXPTF2014.xlsx** (Excel Workbook (Open XML))
 - B. **219SLOEXPTF2014.xlsx** (Excel Workbook (Open XML))
 - C. **Item Analysis MCQ SLO Chem 219 F2014.csv** (Unknown File)
 - D. **SLO 2 & 3 Chem 219 Findings** (Adobe Acrobat Document)
 - E. **SLO 2 & 3 Chem 219 Findings.pdf** (Adobe Acrobat Document)
 - F. **Chem 219 Lab SLO Analysis** (Word Document (Open XML))
 - G. **Chem 219 Lab SLO Analysis Fall 2013** (Word Document (Open XML))
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