

Course Outcomes Guide (COG)

Course Title: CHM 104

Date: June 2019

Course Team: Veronica Stein, Chris Nelling

Expected Learning Outcomes

1. Apply quantitative thinking processes and reasoning skills to core content of the second semester of general chemistry.
2. Communicate core course concepts in writing while using appropriate technology.
3. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. Integrate multiple ideas in the problem solving process. Check results to make sure they are physically reasonable.
4. Collect, analyze, and evaluate empirical data to substantiate chemical concepts.
5. Apply course content to environmental issues (e.g., pollution, global warming, and toxicology).
6. Relate chemical concepts to real life scenarios.
7. Access, process, analyze and synthesize scientific information.

Assessment (How do or will students demonstrate achievement of each outcome? Please attach a copy of your assessment electronically.)

A Nationalized Final Exam written by the American Chemical Society (ACS) for the second semester of General Chemistry is used as the final exam for CHM 104.

MasteringChemistry which is an online homework program is used to assess applying quantitative thinking process and reasoning skills, and solving quantitative chemistry problems and demonstrate reasoning clearly and completely.

Exams, consisting of a combination of multiple-choice, short answer and problem solving questions, are given in the lecture and lab sections of the course. The exams assess critical thinking skills and analyze and synthesis of scientific information.

Validation (What methods have you used or will you use to validate your assessment?)

We compare our students to the national average of the ACS exam. This exam covers material from chapters 11 through 20 in the *Chemistry, A Molecular Approach, 4th edition*, by Tro.

Results (What do your assessment data show? If you have not yet assessed student achievement of your learning outcomes, when is assessment planned?)

For the 2002 version of the ACS exam, each year the students improved their scores on the final exam in general. We updated the exam to the latest version offered by the American Chemical Society. The newer version has ten fewer questions and they do not ask questions on the topics of organic chemistry or properties of various elemental groups. This is an improvement, since I have not been able to cover the chapters on elemental groups.

For the 2010 version of the ACS exam, student scores are generally close to the national mean.

CHM 104			
Semester	n	mean	
06/SP	30	30.8	
06/FA	8	27.6	
07/SP	18	44.5	
07/FA	16	32.3	
08/SP	25	38.92	
08/FA	11	33.18	
09/SP	28	40.04	
09/FA	16	41.3	
10/SP	35	42.8	
10/FA	9	40.3	
11/SP	30	45.2	
11/FA	17	45.8	
<i>National 2002 version</i>	<i>1321 From 17 colleges</i>	<i>39.09</i>	<i>out of 80 questions</i>

CHM 104			
Semester	n	mean	
12/SP	20	41.2	
12/FA	18	36.1	
13/SP	23	42.6	
13/FA	18	33.4	
14/SP	22	41.9	
14/SU	10	35.9	
14/FA	9	32.9	
15/SP	33	37.8	
15/SU	17	33.1	
15/FA	12	30.6	
16/SP	37	38.0	
16/SU	16	33.4	
16/FA	11	31.9	
<i>National 2010 version</i>	<i>Not provided From ACS</i>	<i>36.19</i>	<i>out of 70 questions</i>

CHM 104			
Semester	n	mean	
17/SP	20	37.5	
17/SU	11	36.6	
<i>National 2014 version</i>	<i>4613 From 36 institutions</i>	<i>36.7</i>	<i>out of 65 questions</i>

CHM 104			<i>out of 70 questions</i>
Semester	n	mean	
17/FA	12	33.5	
18/SP	25	39.3	
18/SU	13	34.7	
18/FA	17	36.3	
19/SP	39	41.7	
<i>National 2017 version</i>	252 ACS is normalizing this exam	34.68	

Follow-up (How have you used or how will you use the data to improve student learning?)

I made an Excel spreadsheet table for our adjuncts and me, which correlates the item analysis of the exam to chemistry concepts. Using this we can see which concepts we need to develop better curriculum (practice problems, labs, additional material) for students. For example, to engage the students more in the various concepts, the flipped classroom method should be tried for topics of equilibrium, kinetics and buffers. Assigning dynamic modules in Mastering Chemistry from Pearson will enhance students' learning experience with topics of equilibrium, titration curves and buffers.

Budget Justification (What resources are necessary to improve student learning?)

We plan to update ACS exam for 2nd semester general chemistry to the current version for the CHM 104 course when it comes available.

To improve time the use of time in the lab, we will make prelab video for the students. These video will show basic techniques required to perform the experiment.

Course: CHM 104**SLOA Data****Faculty Team Veronica Stein**

	SU 2009	FA 2009	SP 2010	SU 2010	FA 2010	SP 2011	SU 2011	FA 2011	SP 2012	SU 2012	FA 2012	SP 2013
# Active students	Not offered	18	40	Not offered	13	48	Not offered	19	22	Not offered	22	34
% W		11.1	7.5		0	20.8		0	4.5		9.1	8.8
*% walk-away Fs <small>No final exam/grade = F</small>		0	5.4		30.7	13.2		0	0			11.1
% Success (A,B,C)		72.2	72.5		69.2	51.1		88.2	71.4		85.0	72.7
Mean Common Lab Practical Score												
Common Comprehensive Final Exam Scor (out of 70 questions)		41.3	42.8		40.3	45.2		45.8	41.2		36.1	42.6
Mean course grade		2.31	2.24		2.15	1.83		2.82	2.25		2.78	2.33
% Gen Ed Assessment Score											70.9	87.4
Item Analysis Weakest Content Areas												

*% Walk-away Fs = did not take the final exam and received a grade of F.

Content Areas

Course: CHM 104**SLOA Data****Faculty Team: V Stein**

	SU 2013	FA 2013	SP 2014	SU 2014	FA 2014	SP 2015	SU 2015	FA 2015	SP 2016	SU 2016	FA 2016	SP 2017
# Active students	Not offered	22	31	11	12	47	22	18	37	18	13	28
%W		4.5	12.9	9.1	8.3	14.9	13.6	16.7	16.2	5.6	7.7	7.1
*% walk-away Fs No final exam/grade = F			16.1			10.6			13.5			
% Success (A,B,C)		60.0	64.5	90.0	58.3	57.8	50.0	44.4	48.6	77.8	76.9	58.3
Mean Common Lab Practical Score												
Common Comprehensive Final Exam Score (out of 70 questions)		33.4	41.9	35.9	32.9	37.8	33.1	30.6	38.0	33.4	31.91	38.6
Mean course grade		2.21	2.11	3.30	2.18	1.95	1.79	1.64	1.82	2.29	2.00	2.00
% Gen Ed Assessment Score		87.1	89.1	89.0	85.6	82.4	77.6	77.5	83.5	78.1	86.4	81.5
Item Analysis Weakest Content Areas												

*% Walk-away Fs = did not take the final exam and received a grade of F.

Course: CHM 104**SLOA Data****Faculty Team: V Stein**

	SU 2017	FA 2017	SP 2018	SU 2018	FA 2018	SP 2019	SU 2019	FA 2019	SP 2020	SU 2020	FA 2020	SP 2021
# Active students	16	14	33									
%W	12.5	0	15.2									
*% walk-away Fs No final exam/grade = F												
% Success (A,B,C)	57.1	58.3	60.0									
Mean Common Lab Practical Score												
Common Comprehensive Final Exam Score (out of 70 questions)	36.6	33.5	39.3	34.7	36.3	41.7						
Mean course grade	2.00	2.08	2.24									
% Gen Ed Assessment Score	84.5	85.0	85.6	84.6	79.4	87.7						
Item Analysis Weakest Content Areas				**See below								

*% Walk-away Fs = did not take the final exam and received a grade of F.

****Weakest Content Areas**

Using item analysis on the ACS exam, the following concepts need improvements: colligative properties for freezing point depression and boiling point elevation, rate laws based on reaction mechanisms, determining equilibrium constants, using equilibrium constant and initial concentration to determine equilibrium concentrations, Lewis acids and bases, using periodic trends to determine acid strength, pH of a salt solution, Gibb's free energy, Nernst equation,