D. Summary of Assessment Results

4	Analysis in lab notebook and report	11	69%
4	MC 5-10	6	38%
5	Q10	6	38%
6	Q12	3	19%
6	Gel photograph	14	88%
7	Final lab notebook score	14	88%

*Partial credit was applied to exam questions and lab notebook grading. If 75% off all possible points were earned, the answer was counted as correct.

Analysis: The embedded questions Q9 and Q12 resulted in a very low number of correct answers. Question Q9 addressed learning goal 2 in a quantitative manner. Students had to calculate concrete quantities of chemicals to prepare a buffer. Students performed much better on the qualitative question Q8 that covered the same learning goal. The low score on Question Q12 is unexpected as it is a simple recall question on the full name of a chemical abbreviation paired with a chemical explanation for the purpose of a specific chemical compound. Nevertheless 88% of students were able to master the practical side of learning goal 6. 88% of the students were also able to demonstrate mastery of SLO #7, know how to develop a well-written laboratory notebook which maps to PLO #4 concerning written communication.

Winter 2017 data

R	T
8. know buffer theory and how to prepare a laboratory buffer.	Questions 5 & 6
9. know how to perform protein and enzyme activity assays and how to calculate results from laboratory-derived data.	Question 8& 9
10. know how to calculate data commonly found in Protein Purification Tables and how to interpret this information.	Question 7
11. know how to perform enzyme kinetic data analysis and how to present this data in graphical format.	Multiple Choice Questions 5-10 & Analysis in lab notebook
12. know theory and practical details of chromatographic procedures --including gel filtration chromatography, ion-exchange chromatography, and high performance liquid chromatography (HPLC).	Question 10
13. know the theory and practical details of electrophoresis of proteins and DNA.	Question 12 and photograph of a successful SDS-PAGE protein gel.
14. know how to develop a well-written laboratory notebook.	Laboratory notebook score

BS BiochemistryMajor: 8 students

students pursuing a BA Biochemistry degree (see next table) were unable to answer Q9 correctly. This is disappointing, as problems similar to Q9 were practiced in lecture and in group work. The overall analysis has to be seen as tentative due to the low number of students pursuing either a BA or BS Biochemistry degree enrolled in the course. For the same learning goal, learning goal number 1, embedded questions that addressed qualitative answers (Q5 for example) rather than quantitative calculations (Q6) yielded higher scores in student exams. 100% of the students were also able to demonstrate mastery of SLO #7, know how to develop a well-written laboratory notebook which maps to PLO #4 concerning written communication.

Biochemistry
CHEM 4412 Winter 2017
Biochemistry PLO #1: demonstrate knowledge in the various areas of chemistry, including inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, and biochemistry.
Assessment Tool: Embedded questions on midterm exams and the final exam

Student Learning Outcomes:

1. Distinguish the classes of lipids found in biological systems.
2. Demonstrate knowledge of biological membrane structure/function and mechanisms of active and passive membrane transport.
3. Explain the basic principles of bioenergetics and analyze the standard and actual free energy changes of biochemical reactions.
4. Outline and summarize key cellular metabolic processes.
5. Discuss the importance of metabolic regulatory mechanisms.

Learning outcome	BA Biochem (2 students)	BS Biochem (25 students)	BS Chem (2 students)	Total (29 students)	Question source
#1 with >70% correct answer	0/2 (0%)	14/25 (56%)	2/2 (100%)	16/29 (55%)	Midterm 1 #1
#2 with >70% correct answer	1/2 (50%)	11/25 (44%)	0/2 (0%)	12/29 (41%)	Midterm 1 #4 or #6 in versions A and B, respectively
#3 with	1/2	6/25	0/2	7/29	Midterm 2 #2 or

>70% correct answer	(50%)	(24%)	(0%)	(24%)	#4 in versions A and B, respectively
#4 with >70% correct answer	1/2 (50%)	8/25 (32%)	1/2 (50%)	10/29 (34%)	Final exam #10 or #11 in versions A and B, respectively

7. be able to carry out standard functional group transformations of organic compounds, and isolate and characterize the resulting products.

The outcomes criteria for objectives 1-4 are based on percentiles obtained on the American

	# of students	Both correct	At least one correct	None correct	% Both correct	% One or more correct
Chemistry and Biochemistry Majors	19	14	17	2	74 %	89 %

Analysis: Of the 19 chemistry and biochemistry majors who finished the lab, 89% identified at least

Results of Capstone Organic Laboratory Assignment during 2004 2017 for Chemistry and Biochemistry Majors

Year	# of Chem/Biochem

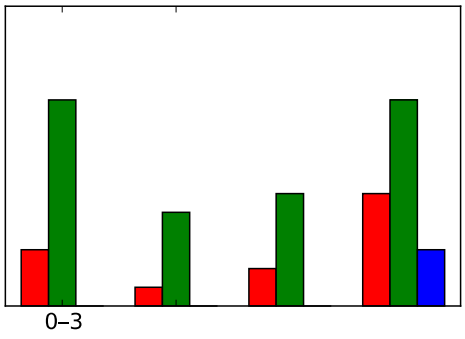
Questions (1-4, 7-10, 14, and 15) were embedded into the final. Taken together, these questions

Question	Number (Percent) of students receiving at least			
	25%	50%	75%	100%
Q1	8 (73%)	6 (55%)	5 (45%)	2 (18%)
Q2	11 (100%)	11 (100%)	10 (91%)	3 (27%)
Q3	7 (64%)	4 (36%)	3 (27%)	3 (27%)
Q4	8 (73%)	8 (73%)	6 (55%)	4 (36%

by degree program (red is B.S. Chemistry, green is B.S. Biochemistry, blue is M.S. Chemistry).

***Learning outcome**: Formulate the mathematical description for the quantum*

***Learning outcome**: Model the vibrational and rotational motion of molecules.*



Plans: In the Winter 2017 quarter, we eliminated the textbook that we had used in the previous

year (Engel and Reid, *Physical Chemistry*, $134 new), and transitioned all course materials to freely available, open educational resources (OER). For the next year, we plan to further develop and improve upon the OER for the course.

E. Suggestions and Recommendations for the CSCI EETF in the Future