The Undergraduate Program Learning Outcomes (PLOs) are as follows:

Students graduating with a BS /BA degree in Chemistry or Biochemistry will be able to:

demonstrate knowledge in the various areas of chemistry, including inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, and biochemistry.

work effectively and safely in a laboratory environment to perform experimental procedures and operate modern chemical/biochemical instruments.

use quantitative reasoning to analyze chemical problems and evaluate chemical data.

4. write and speak clearly on chemical or biochemical issues.
5. work collaboratively in teams to solve chemical problems.

We have gathered data to assess PLO 2, use quantitative reasoning to analyze and solve chemical problems and evaluate chemical data.

Data were collected in Chem 332 (Organic Chemistry II) and Chem 352 (Physical Chemistry II), a standardized national exam in the case of Chem 332, and embedded questions in the final exam. As this is the first time (at least in some time) that Chem 352 data was collected, these data will provide a baseline for future assessments of the course.

4. know and understand the common reaction mechanisms of organic reactions, and indicate the mechanism and type of intermediate involved in the reactions.
5. safely carry out standard laboratory techniques for the purification of organic compounds, including distillation, recrystallization, column chromatography, thin layer chromatography, and extraction.
6. measure the infrared spectrum of an unknown solid or liquid and be able to identify the functional groups present.
7. carry out standard functional group transformations of organic compounds, and isolate and characterize the resulting products.

Modifications to Assessment due to Covid-19

Due to COVID-19 and the University's conversion to on-line courses during the Spring semester, the capstone lab project was not able to be completed. This is where the laboratory portion of the course (SLOs 5, 6, and 7) is normally assessed. Therefore, for this year, only the lecture portion and SLOs 1, 2, 3, and 4 were assessed.

using embedded final exam questions. In this year, all of the final exam questions were used in this assessment report.

Student Learning Outcomes

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Final Exam Questions

1. Consider the first seven lines in the microwave spectrum of MgO.

J	ν (cm^{-1})
	0.5718
	1.1436
	1.7154
	2.2871
	2.8588
	3.4305
	4.0022

   a. Find the reduced mass (μ) of the molecule.
   b. Assign the spectrum (assign the lower J value to each transition) and fit the data to an appropriate functional form in order to determine values for B and D.
   c. Use your value of B and μ to find the value of r (the bond length) for the molecule.

2. Consider a particle of mass *m* in a one-dimensional box of length *a* (defined between x = 0 and x = *a*), for which the wave function is given by .
   a. Make a graph of the wavefunction.
   b. Find the value of *A* that normalizes the wavefunction.
   c. Find the expectation vale <E> for the particle.
   d. Find the expectation value of <x> for the particle.

3. Consider a new element, Crazium, that is discovered to have two electrons in its highest-energy subshell. *l* for this subshell is 3/2. *s* for these electrons is the same as any other electron, 1/2.

   a. What are the possible values of m_s for this subshell?

b. Write an orbital diagram to predict the lowest-energy term symbol for the ground state of Crazium. (You do not have to write out all of the microstates. Just find the ground state using the method outlined in class.)

4. Consider the molecule iodine trifluoride.

a. Using the character table below, find the number of vibrations of a_1, a_2, b_1, and b_2 symmetry.

5. Draw an energy level diagram for a four-level laser system (such as the Nd:YAG laser, and write a paragraph describing how the system achieves a population inversion.

Correlation of Exam Questions

	Q1	Q2	Q3	Q4	Q5
100%	15 (88.2%)	5 (29.4%)	11 (54.7%)	11 (54.7%)	17 (100%)
75%	15 (88.2%)	9 (52.9%)	15 (88.2%)	15 (88.2%)	17 (100%)
50%	17 (100%)	17 (100%)	16 (94.1%)	17 (100%)	17 (100%)
25%	17 (100%)	17 (100%)	16 (94.1%)	17 (100%)	17 (100%)

	Q1	Q2	Q3	Q4	Q5
100%	1 (100%)	0 (0.0%)	0 (0.0%)	1 (100%)	1 (100%)
75%	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)