2022-2023 Comprehensive Instructional Program Review - CHEM Latest Version

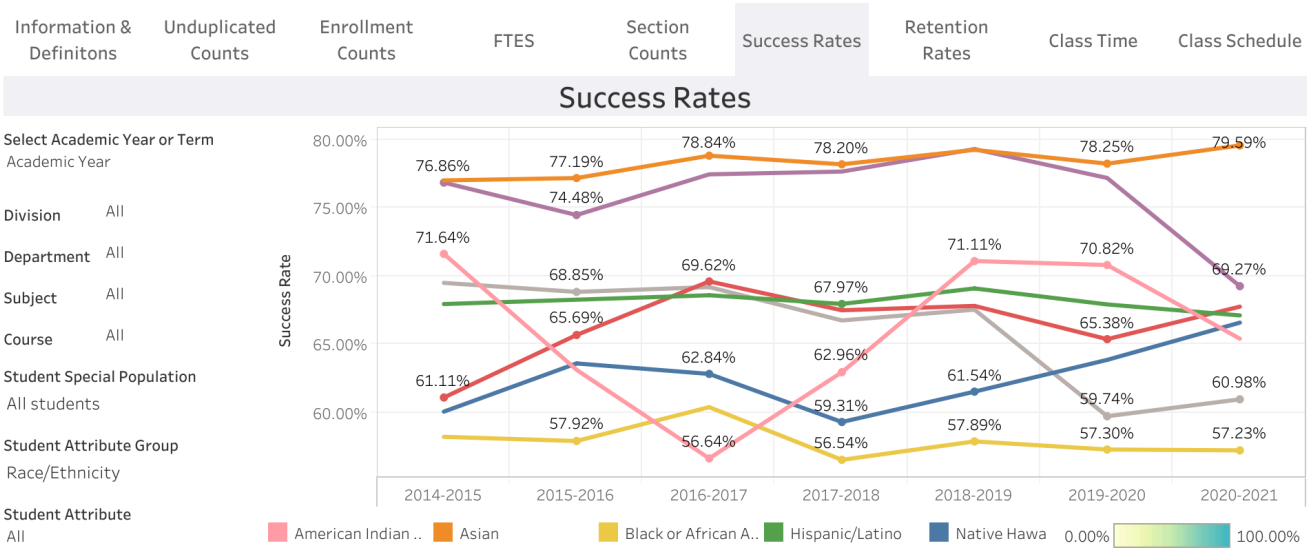
2022-2023 Comprehensive Instructional Program Review

Program Overview and Goals

Mission and Alignment : Version by **Bradbury, Jeffery** on **12/12/2023 18:00**

The mission of the Cerritos College Chemistry Department is to provide outstanding Chemistry instruction and support in order to enable students to achieve their academic and career goals, and to promote awareness of and interest in the study of science. In order to accomplish this mission, we are acutely aware of the diversity of our student population. Cerritos College students are part-time and full-time workers, recent high school graduates looking to transfer to four-year universities, adults looking for a career change and still other students who are interested in technical careers. Therefore, we offer a full range of chemistry classes in the day as well as the evening, to students preparing for careers in chemistry, biochemistry, biology, physics, geology, engineering, teaching, nursing, dental hygiene, physical therapy, pharmacy, medicine, dentistry, chiropractic, criminology, forensics, environmental science, forestry, and more. Moreover, we must provide the support services necessary to give our students the best chance to achieve their goals. The careers that we help students prepare for are on technology's cutting edge. Therefore, in order for our coursework to be relevant, it is imperative that we take advantage of modern technology and scientific instrumentation. Furthermore, working with chemicals is inherently dangerous and so safety is a critical concern. Finally, outside of career development, we must create an atmosphere that encourages a zest for life-long learning and a general awareness of and interest in the study of science. The Cerritos College Chemistry Department offers transfer level courses in introductory chemistry, general chemistry, organic chemistry, allied health chemistry, and chemistry for elementary school teachers. We offer an Associates in Science for Transfer (AST) degree in Chemistry. In an effort to provide students with learning experiences that incorporate modern laboratory techniques, advanced instrumentation and advanced technology, department faculty have integrated microscale equipment and techniques in the laboratory and use advanced technology to develop innovative programs for the classroom. The Cerritos College Chemistry Department vision is to play a leading role in the education of our chemistry students who will be tomorrow's leaders in medicine, education, industry and government.

Explain how your program supports the College's Mission.
Cerritos College provides its diverse student population with high-quality, comprehensive instructional programs and support services through clear, equity-minded pathways to their educational goals. In doing so, the college develops culturally competent students with the knowledge, skills, and values that prepare them to be productive members of their local and global communities. This graph shows the success rate of the college as a whole.



Division	Department	Subject	Course	Student Attribute	2014-2015 Academic Y..	2015-2016 Academic Y..	2016-2017 Academic Y..	2017-2018 Academic Y..	2018-2019 Academic Y..	2019-2020 Academic Y..	2020-2021 Academic Y..
Apprenticeship	APP	FSAP	FSAP 72.01	American Indian or ..						100.00%	
				Asian					33.33%	100.00%	
				Black or African A..				50.00%	80.00%	100.00%	
				Hispanic/Latino				75.00%	78.26%	100.00%	
				Native Hawaiian or..				100.00%	100.00%	100.00%	
				Two or More Races					50.00%		
				Unknown				90.00%	66.67%	100.00%	
				White				64.71%	75.56%	86.67%	
			FSAP 72.02	American Indian or ..						100.00%	
				Asian							

The Cerritos College Chemistry Department serves a very diverse population of students. The chemistry department has a range of success rates among different ethnic groups **ranging from 54% to 79%, which is similar to the colleges range of 52% to 79%**. The success rate in chemistry for males and females is 61%, although in the latest semester reported there were 644 females and 411 males. The department is committed to preparing the students for being productive members of society. The vast majority of our students transfer to four-year universities. The department has spent many years nurturing relationships with local universities and industry to provide summer research experiences and internships vital to their educational experience. In October 2019 the department hosted the first ever chemistry job fair where representatives from over a dozen local chemistry related businesses spoke with our students. Several of the representatives were former Cerritos College students. The department provides much support systems for our students. Perhaps the best example is the tutoring program. The majority of our chemistry sections have embedded tutors and we also have general tutoring throughout the school day. These are just a few examples of how the department supports the overall mission of the college. This graph below shows the overall success rate of the chemistry department.

Degrees and Certificates : Version by **Moskun, Amy** on **11/14/2022 04:06**

List the degrees and certificates the program offers as well as the number of units or courses required to complete the program.

Degrees	Chemistry Units	Total Units
Associate in Science in Chemistry for Transfer (AS-T)	20	60 total 8 Math 8 Physics

Six-Year Program Goals : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

https://programmap.cerritos.edu/academics/interest-clusters/9f469029-d00c-4838-83d7-25b78e5492e0/programs/7037abf5-f2bd-ced2-7999-1663f1bd1563
(https://programmap.cerritos.edu/academics/interest-clusters/9f469029-d00c-4838-83d7-25b78e5492e0/programs/7037abf5-f2bd-ced2-7999-1663f1bd1563)

Program Goal	College's Goals Supported (Goal A - Goal F)	Status (not started; in progress; on hold; cancelled; completed; continued)	Action Plans/Timelines/Resource Needs
Hire and mentor additional full time faculty	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	In Progress	We have completed the process of hiring two new full time faculty that started in Fall 2022. We plan to request two more full time faculty for the next year. In the Fall of 2022 the chemistry department will offer 64 sections 26 (40%) of which will be taught by full-timers. We continue to be understaffed. We will continue to request additional faculty members to support our current and continued growth due to high student demand for chemistry courses. While we are very grateful that we were approved to hire 2 full time faculty we have concerns with the FHP process and the number of full time faculty hired by the college. The college faculty hiring process does not serve our students well. The FHP prioritization is primarily based on the ratio of section numbers to FT faculty in a department. Section numbers can be misleading as courses can range from 1 unit to 6 teaching units. In the sciences, there is a limited pool of quality instructors for part time instructors and we struggle to staff classes. Due to this issue many of our students have been forced to go to other local community colleges for their transferable science courses. With the current process, our science students will continue to be pulled to other institutions that are able to offer additional sections of SEM courses. In the current FHP cycle, Chemistry was ranked 25th. It is our understanding that the state of California has set a target of around 70-75% of sections to be taught by full time faculty load. If the Chemistry department is ranked 25th in need how can the college be anywhere the state recommendations. We strongly believe that our students are better served by full time faculty that are dedicated to the institution and available to students rather than part time faculty stretched very thin amongst 3-6 institutions to make ends meet. As a college we need to prioritize our students learning experience and success by investing in dedicated full time faculty. It is the faculty that teach the courses, connect with students daily and can make or break a student's success.

Program Goal	College's Goals Supported (Goal A - Goal F)	Status (not started; in progress; on hold; cancelled; completed; continued)	Action Plans/Timelines/Resource Needs
Improve safety training for students, full time faculty and part time faculty	GOAL C: PROMOTING LEADERSHIP AND STAFF DEVELOPMENT	In Progress	We are in communication with American Chemical Society over updating our student safety training. Some faculty are using Flex hours to update safety training. At the very least we need to improve our safety test WHICH IS TAKEN BY EVERY LABORATORY STUDENT AT THE BEGINNING OF THE SEMESTER.
Increase faculty participation in SLO process	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	In Progress	Faculty discuss SLOs formally at department meetings and informally in "hallway" discussions.
Update pedagogical technology. (replace dated and failing ipads), Use research-based, guidance-embedded inquiry learning technology to improve student learning software - (nomenclature, titration, new spectroscopy) Molecular modelling. Purchase CHEM Draw for all instructors.	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	In Progress	We are in the process of purchasing new class sets of iPads. We use them extensively in Chem. 110, 111 and 112. We need to implement and integrate the use of the iPads in Chem. 100. We need to figure out how to get chemistry specific software onto the iPads. This includes apps such as Odyssey.We need to get screen casting apps on the iPads. This will involve meeting with IT which is now in charge of updating the software and maintaining the iPads.
Align department with Career Pathways/Program Mapping (GOAL A)	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	In Progress	This can be done during the Spring semesters Rena/Co-chairs will be meeting with counselors. We have completed the full-time student program mapper and are currently working on the part time student map. https://programmap.cerritos.edu/academics/int clusters/9f469029-d00c-4838-83d7-25b78e5492e0/programs/7037abf5-f2bd-ced2-7999-1663f1bd1563
Reallign curriculum in Chem 110/111/112 to better fit order in most textbooks	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	Not Started	This may be put off until new faculty are hired and mentored. We need to re-align the curriculum with the text book. We need to change the order of topics in 111 and 112 to better align with the needs of engineering students that only take Chem. 111 and not 112. We need to make sure that they learn needed content. We also need to align better with State guidelines. This involves coordination of lecture and lab topics. That is the issue that makes this time consuming and difficult.
Update Chemical Label system	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	In Progress	This is being done by the new stockroom technician. But this is a continuing process. We are already noticing many more correct labels on our reagents. This significantly improves safety.
Increase laboratory space	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	Not Started	This has only been briefly discussed by the department and the dean. We have significantly increased our course offerings. For example, we have gone from 6-7 sections of Chem. 110 to 9 sections of Chem. 110. We have also increased THE NUMBER OF SECTIONS OF Chem. 100, 111 and 112. We need lab space if we continue to increase our course offerings. This will either involve an entirely new building or adding a lab over the existing bio lab. S-127. We cannot just have a mobile general science lab out in the parking lot. Also any new lab space must be in very close proximity to the chemical stock room. We cannot be carrying sulfuric acid across the campus.

Program Goal	College's Goals Supported (Goal A - Goal F)	Status (not started; in progress; on hold; cancelled; completed; continued)	Action Plans/Timelines/Resource Needs
Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	Not Started	This may be put off until new faculty are hired and mentored. We are in constant discussion about the need to develop the chemistry tech program. We have visited local industry to see what technology is used and we have discussed as a department what equipment would need to be purchased. The list will be found in the equipment request below. Our new faculty are eager to participate in this.
Develop chemistry technician certificate program	GOAL A: STRENGTHENING THE CULTURE OF COMPLETIONGOAL B: ENSURING PROGRAM ALIGNMENT BY STRENGTHENING PARTNERSHIPS	On hold	This may be put off until new faculty are hired and mentored. See comment directly above. Our new faculty are eager to participate in this.
Maintain current and develop new relationships with local chemical industry	GOAL B: ENSURING PROGRAM ALIGNMENT BY STRENGTHENING PARTNERSHIPS	In Progress	This is ongoing. We have been forming relationships with local industry and channelling students into some local chemical companies. We need to maintain relationships with students that have gotten hired by industry. We have visited local industry and we will continue to develop these kinds of relationships. Our new faculty are eager to participate in this.
Maintain current and develop new relationships with local universites and other places where students can do summer research experiences	GOAL B: ENSURING PROGRAM ALIGNMENT BY STRENGTHENING PARTNERSHIPS	In Progress	We send 3-6 students each summer to perform a Summer Research Experience (REU WHICH STANDS FOR UNDERGRADUATE RESEARCH EXPERIENCE). Several of these students have gone on to graduate work. The summer program at USC has expanded the number of students they take from us for 8 weeks of summer research. At the end they do a 10-15 minute presentation of their project. Over the 11 years we have done this partnership we have gone from 4 professors at USC requesting students to 7.
Ressurect the biology/chemistry curriculum pathway information meeting for Chem. 110 and Bio 120 students.	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	In progress (planned for fall 2022)	The plan is to host a meeting with students and biology and chemistry faculty in the fall to discuss course pathways.
Hire a second full-time stockroom technician and have adequate coverage of the stockroom	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	Not started	We need a higher level trained technician working at night (5 pm-10pm) when the majority of our courses are taught by part time faculty. We often do not even have a student hourly worker in the stockroom at these times. This is unsafe.
Explore Open Education Resources	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	In progress	We have chosen an OER text for Organic Chemistry. Those books can be $300 dollars! So this would be a big savings for students. We are also going to choose a OER book for Chem. 100.
Set up department Google Drive for resources, training, mentoring and embedded tutors.	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	In Progress	Hire a student hourly to help with this.
Creation and implementation of online consumer chemistry general education course.	GOAL A: STRENGTHENING THE CULTURE OF COMPLETION	In Progress	Linda Waldman is creating this course during her sabbatical(2021-22). The plan is to run one section of this course in THE FALL OF 2023.
Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: UPGRADING EDUCATIONAL INFRASTRUCTURE	In Progress	We need to upgrade, maintain and acquire chemical instrumentation, chemical supplies, glassware, hardware, measuring equipment, etc so that our students are highly prepared to transfer and succeed at a four-year university, go out and do STEM careers, graduate school and/or scientific research.

Assessment Report and Data Analysis

Assessment Report (Part 1: Assessment Table) : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

In the midst of the constant uncertainty and changing plans of the COVID-19 Pandemic as well as being understaffed, the chemistry department did not complete formal course SLO in 2020-2021. All course **Faculty** coordinators are working with faculty to ensure that SLO's are submitted for all courses this year.

While, the department did not complete the formal SLO process, we have been in constant discussion about how to best support our students in this new online learning environment. Our response in each course has been collaborative and constantly evolving with the goal of student success.

Course by SLO	Expected Performance	Performance
CHEM111 - General Chemistry		
Apply knowledge of microscopic (molecular) interactions to explain or predict macroscopic properties (Active from 2019 FA)	100.00%	35.00%
Apply critical thinking strategies in solving algorithmic and conceptual problems in chemistry (Active from 2019 FA)	100.00%	28.21%
In lab, incorporate chemical principles to explain lab results and vice versa (Active from 2019 FA)	100.00%	57.89%
Apply laboratory skills such as lab weighing, drying to constant mass, making solutions, titrations, taking gas measurements, measuring pH, and measuring electrical conductivity to perform chemical analysis including collection of data, computations, and statistical analysis of the results (Active from 2019 FA)	100.00%	47.50%
Use effective written communication of chemical information in lab reports and on exams (Active from 2019 FA)	100.00%	23.68%
Make effective use of current technology to collect and analyze data in lab (Active from 2019 FA)	100.00%	48.72%
CHEM211 - Organic Chemistry		
A. Demonstrate understanding and problem-solving skills in stereochemistry and spectroscopy (Active from 2017 FA)	100.00%	44.16%
E. In lab, demonstrate motor skills and mastery in basic organic lab techniques (Active from 2017 FA)	100.00%	52.21%
D. In lab, demonstrate effective written communications in theory and understanding of basic organic chemistry lab techniques (Active from 2017 FA)	100.00%	61.03%
C. Propose and draw a nucleophilic substitution or elimination mechanism to explain organic product formation (Active from 2017 FA)	100.00%	87.32%
B. Identify the products of simple and multistep organic reactions of alkanes, alkenes, alkynes, alcohols, and halides (Active from 2017 FA)	100.00%	40.14%
CHEM212 - Organic Chemistry		
A. Propose multistep synthetic processes for a desired organic compound (Active from 2017 FA)	100.00%	30.77%
E. In lab, demonstrate motor skills and ability to separate, purify, and identify organic compounds (Active from 2017 FA)	100.00%	67.95%
D. In lab, demonstrate effective written communications and technological competency through use of instrumentation and computers (Active from 2017 FA)	100.00%	59.74%
C. Draw reaction mechanisms to illustrate organic reactions and explain product formation (Active from 2017 FA)	100.00%	30.77%
B. Identify the products of simple and multistep organic reactions of alkenes, alkynes, aromatic compounds, organometallics, alcohols, amines, aldehydes, ketones, and carboxylic acids and their derivatives (Active from 2017 FA)	100.00%	30.77%
CHEM - 100 - Introductory Chemistry		
Students analyze the fundamental features of inorganic chemistry as it applies to organic and biochemistry including measurement, mathematical interconversion of physical properties such as mass, volume, density, temperature, solutions. (Active from 2013 FA)	100.00%	47.27%

Course by SLO	Expected Performance	Performance
Students demonstrate knowledge of the qualitative features of inorganic chemistry as it applies to organic and biochemistry including physical and chemical properties, naming and writing chemical formulas of commonly occurring inorganic compounds and evaluating chemical reactions. (Active from 2013 FA)	100.00%	30.86%
Students differentiate typical acid and base formulas and compare/contrast the behavior associated with acids and bases including the behavior of buffers. (Active from 2013 FA)	100.00%	30.77%
Students construct and name structures containing common mono-functional organic molecules and differentiate functional groups when they appear in an organic structure, relate the physical and chemical properties of compounds containing these groups with the structure of each functional classification. (Active from 2013 FA)	100.00%	25.89%
Students distinguish various roles of four major classes of biomolecules in living cells, distinguish and construct key structural features and common reactions of these classes of biomolecules. (Active from 2013 FA)	100.00%	27.24%
CHEM - 110 - Elementary Chemistry		
Students incorporate chemical principals to explain lab results and vice versa (Active from 2014 FA)	100.00%	52.41%
Students write correct chemical formulas, predict balanced equations, net ionic equations and total ionic equations. (Active from 2014 FA)	100.00%	26.85%
Students will use chemical information to solve stoichiometric problems in solid state, solutions and gaseous state (Active from 2013 FA)	100.00%	34.12%
Students use dimensional analysis to perform unit conversions and chemical calculations. (Active from 2014 FA)	100.00%	40.43%
CHEM - 111 - General Chemistry		
Students read and interpret graphs and data. (Active from 2014 FA)	100.00%	62.62%
Students demonstrate an understanding of the attractive forces/bonds between atoms, molecules and ions and how those forces influence chemical and physical properties of the substance (Active from 2017 SP)	100.00%	49.72%
Students write and manipulate equilibrium equations and expressions in order to determine the direction of the reaction and then calculate the concentrations of species before equilibrium and after reaching equilibrium. (Active from 2017 SP)	100.00%	28.65%
Students demonstrate the quantitative skills needed in stoichiometric calculations (Active from 2017 SP)	100.00%	40.45%
CHEM - 112 - General Chemistry		
Students demonstrate the quantitative skills needed to succeed in Chemistry. (Active from 2014 FA)	100.00%	17.12%
Students apply the scientific method in lab experiences to interpret information and draw conclusions. (Active from 2014 FA)	100.00%	58.90%
Students demonstrate the ability to think critically and employ critical thinking skills. (Active from 2014 FA)	100.00%	26.95%
Students demonstrate the ability to make connections between concepts across General Chemistry. (Active from 2014 FA)	100.00%	31.93%
Students read and interpret graphs and data. (Active from 2014 FA)	100.00%	38.66%
CHEM - 250L - Special Topics In Chemistry		
Students apply knowledge of chemistry to design or redesign an experiment. (Active from 2013 FA)	100.00%	100.00%
Students apply critical thinking strategies in solving algorithmic and conceptual problems in chemistry. (Active from 2013 FA)	100.00%	100.00%
Students incorporate chemical principles to explain lab results and vice versa. (Active from 2013 FA)	100.00%	100.00%

Course by SLO	Expected Performance	Performance
Students apply laboratory skills to perform quantitative and quantitative chemical analysis including collection of data, computations, and statistical analysis of the results. (Active from 2013 FA)	100.00%	100.00%
Students use effective written communication of chemical information. (Active from 2013 FA)	100.00%	100.00%
Students make effective use of current technology to collect and analyze data. (Active from 2013 FA)	100.00%	100.00%

Assessment Report (Part 2: Assessment Responses) : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

The thing that chemistry has been discussing is the way we collect data on SLOs. For the past several years we have used 1) Performance on exams as a whole, 2) Performance on specific questions on exams, 3) Performance on quizzes, 4) Performance on laboratory reports 5) Performance on laboratory tasks. As a department we need to come up with a better process of collecting SLO data for the purpose of reporting and long term analysis. The process to this point has not been unfruitful. We have learned some significant things about our students and our instruction. We offer up a significant example of what we have learned and what we need to do going forward. Chem. 110 is the entry point for a significant number of our students (540). The success rate for this class in 2014-15 was 62%. The success rate decreased to 56% in 2017-18 and then has edged up to 58% in 2020-21. This class has our lowest success rate and is a course that roughly half of our students entering chemistry will be required to take. There is a foundational skill/concept in chemistry called dimensional analysis. Students must master this problem solving skill in order to succeed in chemistry. This concept is taught the very first day of Chem. 110 and used almost every day all the way through Chemistry 111 and then frequently in all subsequent courses. It is critical that we best measure student success on this skill and that we learn how to improve student success in this skill. It is a difficult skill for students to learn. When it comes to measuring and improving student success in dimensional analysis our department has done much discussing and working towards improvement. Do the students need to master dimensional analysis the first day they learn it? Do they need to have mastered it by the end? When do we measure student rates of success on dimensional analysis. These are the questions we discuss all the time. Chemistry 110 is also a highly coordinated course. Many different full-time and part-time instructors teach Chem. 110. There is a tremendous amount of mentoring that goes on between the **faculty** coordinator and part-timers, especially first time part-timers. The **faculty** coordinator meets at least one hour per week with the part-timers to talk about issues related to the instruction of Chem. 110. The **faculty** coordinator helps with writing of exams and wording of questions and all instructors use the same lecture outline with the same practice and lecture problems.

When it comes to dimensional analysis, something that is used everyday, ideally the students would reach mastery of the concept by the middle of the semester carrying forward to the end of the semester and beyond. It is like learning to drive. It takes time, but at some point it is necessary to master driving. It will be used the rest of ones life. Driving is a foundational skill. Such is dimensional analysis to chemistry. We even devoted an entire lab period to learning this skill. Initially we took our SLO measurement as a lab quiz a week after the dimensional analysis lab. The quiz was given somewhere between week 3 and 4. The student success was low. What we decided at the time was that the questions we asked were too difficult *at that point of the semester*. It was observed by several instructors that by 75% of the way through the semester students were doing much better using dimensional analysis problems on chemistry problems when it really mattered. We discovered that we were expecting mastery too soon. It was like we were expecting students to drive on the freeway when they were just learning to drive in a private neighborhood with few hazards and low traffic. We found that we could back off the difficulty of questions on the dimensional analysis quiz the third week of the semester and we would get more success on that quiz as well as good success on the fourth exam when students performed stoichiometry, which is a high level task integrating chemical knowledge with dimensional analysis mastery. We learned that foundational skills take time to learn. But we also realized that the best way to report SLO data if we are going to provide a snapshot of student performance, would be to take that snapshot later in the semester. This will be attempted in the Fall 2022.

In the case of another SLO for Chem. 110 that is just as foundational we need to make improvement. Nomenclature, naming of compounds and writing formulas of compounds is equally as foundational as dimensional analysis. Nomenclature requires memorizing about 70 ions and then writing these ions in a chemical formula. For example, the formula for ferric sulfate is $Fe_2(SO_4)_3$. Writing and naming formulas is necessary to writing the balanced chemical equation and performing many chemical calculations. If a student does not learn to name, they won't succeed in chemistry. There is a significant section of the final exam devoted to writing and naming formulas of chemical compounds. We have found that the students do not perform very well on this part of the exam, even though it is at the end of the semester. We have taken several steps to improve student success and must take more steps. We have set aside an entire lab period for nomenclature. We have several quizzes on nomenclature. And we have reduced the number of ions that is required to memorize. Our next step will be to have more frequent quizzes on ions and formulas throughout the semester to make sure students are maintaining their skill and memory of naming and writing compounds.

This is a view into how the chemistry department processes data of student performance. We have a culture of collaboration and mentoring. We are always informally discussing how to improve student success. We often trade exams. New instructors are expected to share their exam with a mentor and the mentor makes comments and suggestions on those exams. All instructors use the same lecture outlines. Mentors will talk about the lecture material and meet regularly with newer instructors. We have created a nonthreatening environment where instructors feel free to talk about their struggles in the classroom and not be made to feel incompetent or deficient. Our dean has commented very positively on our process for looking at SLOs and working towards student success.

In the year 2020-21 the campus wide success rate was 67.55%. The Success rate of the SEM division was 58.13% The success rate across the chemistry department was 61.64%.

Explain the frequency (i.e., when and how often) and content of assessment process (e.g., planning, data collection, and results) for the program (e.g., department meetings, advisory boards, etc.). Also, describe the process for reviewing and discussing outcomes data.
The Chemistry department is constantly discussing SLOs and how to improve student learning. Many in the faculty teach the same courses so that this allows for much overlap, coordination and platform for discussing student success and progress. These discussions occur in department meetings but also very frequently in the hallways and offices. The chemistry department has created a culture of trust, interaction and mentoring. Thus discussions of improving student success are like the air we breathe.

Chem. 110
This course is highly coordinated which means that most of the quizzes and exams are similar across all sections and instructors. This coordination allows for quality discussion of student outcomes on specific questions or assignments. Discussions occur at formal and informal levels. There are many "in the hallway" discussions of student outcomes such as dimensional analysis. These discussions also occur at the department meetings. Over the last program review cycle many hours were spent discussing Chem. 110 and how to improve teaching. During this cycle the Chem. 110 **faculty** coordinator (Sean Bonness) had the part time instructors ask questions on exams that were similar in nature and spent much time discussing with individual instructors about grading and instructing. A significant amount of mentoring occurs between full-time instructors and adjunct instructors.
Describe the process for development of plan for improvement and summarize the changes that discipline faculty plan to implement based on the analysis of the student learning and program effectiveness. Provide specific examples.
Chem. 110
Recently in Chem. 110 after each instructor gave a similar quiz on dimensional analysis there was much discussion on the success of the students. When it came to analyzing the SLO for dimensional analysis the question was asked: "Should we measure this SLO at the beginning of the course when it is first taught or at the end?" Dimensional analysis is used throughout chemistry and is a foundational skill in problem solving throughout every chemistry course. Earlier it was determined by the department that dimensional analysis is so important that it was decided to **devote an** entire lab period during the second week of lab to practicing dimensional analysis. The following week the quiz is given. It is often found by instructors that too many students performed poorly on this quiz. Yet it was also found that later in the semester the students were doing better on dimensional analysis questions. It was determined by the faculty that the quiz after the second week of lab was too difficult and that students needed more time to practice and learn dimensional analysis. It was decided that faculty would give a less difficult quiz on dimensional analysis towards the beginning of the semester. This allows for greater success on the quiz and a better building of student confidence. The performance on an appropriately easier quiz, appropriate to the early time in the semester and student skill at that point, was much higher. The success at later parts of the semester also was maintained.

During the last program review cycle it was decided that the department would discuss adding a fifth unit to Chem. 110, which is currently 4 units. Rena Lou did extensive research on surrounding colleges to see if other campuses offered equivalent courses to our Chem. 110 that were 4 units or 5 units. After much research and many discussions in department meetings

it was determined that it would be best to maintain our Chem. 110 at 4 units.

Chemistry 110 is our entry level course where students begin their journey through up to 5 semesters of chemistry. Much discussion occurs in the hallway and in department meetings regarding Chem. 110. Over the years many changes and updates have been made. As a result of the analysis of student performance new lab assignments have been added to Chem. 110 to reinforce the most significant and foundational concepts. In addition to the dimensional analysis lab we have also added labs on nomenclature, mole calculations and Lewis dot structures. The department has also utilized new technology to facilitate this learning. For example in some of the sections iPads are used by certain instructors to allow students to create "screencasts" of the student answering specific chemistry problems. Here is a list of the changes that have been made to chem. 110 after serious reflection and discussion by the faculty: After reflecting on Chem. 110 and the changes we have made over the years to improve student success we realized that we have done a lot. So we came up with a list.

Ways we have attempted to improve student success in Chem. 110 over the last 20 years:

1) Dedicated one lab period to dimensional analysis lab
2) Dedicated one lab period to nomenclature lab
3) Instituted online homework for quicker feedback
4) Posted keys to old worksheets for extra practice
5) Nomenclature lab on iPads for instant feedback
6) Capstone lab replaces Lab Practical
7) Free response final exam replaces multiple choice final exam
8) Posted Practice exam online
9) Send practice exam keys to student
10) Mentored adjunct and new faculty
11) Posted online videos of problems
12) Very organized and specific lecture outline that focuses student's on most important information
13) Utilize iPad Pro for improved clarity of lectures each instructor now uses an iPad.
14) Department embedded tutors
15) Occasional supplemental instruction
16) Some instructors use iPads in one lab period to have students create "screencasts" of their solving of chemistry problems and drawing of diagrams.

Much of this has been a lot of work on the part of the department. All of this change has come after much departmental reflection (the way the SLO process is supposed to work). We don't think these changes are trivial. And this change has been a concerted effort by the entire department. It is good to reflect and use our collaborative creativity and energy to add new ideas to our pedagogy. We have been doing that! And this has been a bedrock of our department for decades now. The department is constantly reflecting and discussing how to improve. When we look at overall Chem. 110 success data we see that in 2014-15 the success rate was 62% it dipped to 56% in 2017 and is back up to 58%. However, if we look at the raw data of just the sheer number of students that have taken the course over that span it has increased significantly from 417 to 540 students. The sheer number of successful students increased from 261 to 315. We are serving more students and more students are succeeding in Chemistry 110. We have also increased the number of sections from seven to nine. For several semesters Chem. 110 also has one section dedicated to a class of high school students.

The chemistry department spends a significant amount of time mentoring new faculty, especially for Chem. 110. The **faculty** coordinators for Chem. 100, 110 and 111 each spend at least an hour per each week with any new instructor. The lab process is discussed each week. Instructors are mentored in how to teach problem solving, write exams and quizzes and how to grade exams just to name a few things. We believe this makes a difference in student success. It is important that students succeed in Chem. 110 because it is foundational to their success in Chem. 111 and beyond.

During the Fall 2021 it was observed that the performance of dimensional analysis problems on Exam 4 and the Final Exam has improved. But the weakness we need to work on now is nomenclature. We are in the process of developing ways to improve student performance in nomenclature. We are just starting this process but we are considering having the students learn the ions in smaller "chunks" and then giving more short quizzes to make sure they memorize all of the ions. Knowing the ions is critical to nomenclature and long term student success in chemistry.

Response to Covid **Pandemic**:
When Chem. 110 lab abruptly went off campus faculty made two significant responses to allow lab to move online:
1) Many labs were performed by the instructor and videoed or pictured so that students could make observations and conclusions
2) Online PHET **(Physics Education Technology)** simulations were employed to illustrate chemical techniques and concepts.

In response to moving to hybrid labs and maintaining spacing faculty have created a structure where students were put into three groups of ten. These groups rotated through the labs performing five experiments on campus and the rest online. This meant that faculty had to facilitate three different groups of students doing three different lab activities at the same time. All of this occurred after the stockroom **technician** left the position.

The SLO discussions and thought in the chemistry department is most heavily done for Chemistry 110. This is because in Chem. 110 the success rate is the lowest (around 55%) and so many different instructors teach Chem. 110. But we also spend ample time analyzing data and discussing student success in the higher level courses. Below are lists and bullet points of what has been done in recent years:

CHEM 111

- **CHEM 111 instructors meet weekly to discuss upcoming lab and lecture material and anticipated challenges that students will face. CHEM 111 is a highly coordinated course with all instructors using the same lecture outline to present course content. The instructors compare approaches to the following:**

Lecture.

- Updated (added and subtracted) SLOs
- Reorganized units so tough material spread more evenly on exams. Includes important nomenclature, chemical equations and stoichiometry on exam 1 instead of quiz only
- Began utilizing a "flipped" classroom

Lab

- Modernized experiments using Vernier probes
- Increased computer graphing and data analysis
- New intermolecular forces experiment
- Electronic lab notebooks - Lab archives
- Added new lab experiments

Response to COVID Pandemic

- Instructor switched to remote instruction meeting with students for lecture and lab
- Lecture was very similar to pre Covid times. More take home or open note quizzes and exams
- Lab was a mixture of at home experiments and dry labs with videos illustrating techniques and experiments. Moving towards more hybrid labs. Students broken up into 3 groups that cycle through in campus lab experiments and virtual and home experiments. Fall 2021 2 out of 4 sections hybrid. Spring 2022 6 out of 6 labs scheduled as hybrid
- All data analysis preserved - if students are unable to collect comparable data at home safely, **then** data is provided through tables, pictures and videos.
- Electronic Lab notebooks - lab archives allows students and instructor to work from any location. Allows for **faculty** coordinator to quickly push updates to students and instructors in all sections in these uncertain times.
- Chemical literature - Introduction to literature searching, peer review and types of articles available in the chemical literature.

CHEM 112
Updated SLOs.
Lecture

- Made minor changes to lecture material sequence to better balance the material across each unit.
- Use iPads to help students visualize molecular models
- Purchased model kits to help students touch and see VSEPR models
- As a result of the use of the model kits and molecular modeling apps on the iPads students have improved significantly on exam 2 which covers molecular structures

Lab

- Employed Vernier spectrophotometers replacing traditional spectrophotometers
- Obtained new and better centrifuges
- Made Cation (III) lab quiz a lab practicum rather than a written quiz

Response to Covid Pandemic
Chem. 112 lab has several experiments that last several weeks at a time. Also there are fewer readily available PHET **(PHET Originally stood for Physics Education Technology but now includes many other subjects.)** simulations that are appropriate for this level of chemistry. Therefore Chem. 112 was the most difficult course to move online during Covid. As a result a partnership was developed with a professor at USC that is creating a database of molecules. This required students to access up to date chemical research literature, data mine it for the correct information on the molecules of interest, and correctly put that data into a spreadsheet. This experience was performed completely online.

- Chemical literature research included an embedded librarian. Students learned how to perform literature searches in Scientific literature databases and extract specific sought after **data. Students** learned the difference between review articles and research articles
- Using online apps to draw molecular models
- Molecule project **partnered** with a chemical researcher at USC to build a database of several thousand molecular junctions.
- Developed relationship with American Chemical Society to gain full access to their chemical literature
- Developed labs that can be done at home either using online simulations or having students obtain simple chemicals from the pharmacy to have them do experiments at home

Response to Hybrid

- Developed simulations using Beyond Labs website
- For on campus rotation instructors chose the best labs that students had missed over the previous semesters, such as acid base titrations to give students the best experience.

The chemistry department has been extremely flexible and quick on their feet during Covid-19. Much of the content has been developed slowly and tested and discussed over long periods of time and deep thinking. The curriculum had taken 50 years to get to the point where it was in January 2020. Much, if not most, of the curriculum and labs were thrown out and redeveloped within a matter of weeks! The process of tinkering has been ongoing since. Many activities, labs, and experiments have been changed each semester to make improvements. The chemistry **department** has a culture of improvement. That culture of improvement has gone exponential during Covid.

Data Analysis of Program Data : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

The chemistry department has seen a significant increase in FTES since 2014-15 from 309 to 411. This 33% increase over 6 years has occurred while the college has seen a 25% drop in enrollment.

Describe your student demographics (race/ethnicity, gender, age, and others that might be relevant). Consider the following questions when writing your response:

- How do the demographics of your program and its related courses compare with the college as a whole?
- Have they changed over time?

- Decrease in DSPS students
- Decrease in veteran students . Generally the decrease in numbers for DSPS (SAS) students and veteran students matches the college and SEM Division.
- Very steady increase in female students from 691 to 1049. Male students are between 600 and 740 over the last 6 years. So female students have steadily increased while male students have fluctuated some. The success rate for males and females is roughly the same with trendlines frequently crossing.
- When we look at age of students the 20-24 age group has decreased some the past year from around 800 to 728. But the 19 and under group has increased steadily the past 6 years from 252 to 566. So we are seeing a downward trend in age. Students 25 and older seem to have held fairly steady.
- We have generally seen an increase in the number of first-generation and non-first-generation college students although the percentage of each has remained roughly the same. There currently is about a 6% difference in success rate among 1st and non 1st generation students. Perhaps we could look at ways of closing that gap.
- Enrollment percentage based on ethnicity has remained fairly constant with Hispanic/Latino seeing increases in percentage and raw number.

Headcount (unduplicated) and enrollment (duplicated) in the program. Consider the following questions when writing your response:

- Identify enrollment trends.
- Have there been an increase or decrease in enrollment in the last year?
- Are there differences in trends when you disaggregate the data (e.g., online versus face-to-face, demographics, special populations, etc.)?
- How will enrollment trends affect staffing decisions?

Our chemistry department enrollment and course offerings continues to increase. We have significantly increased the number of sections of Chem. 100. We plan to offer a consumer chemistry course in Spring 2023 so that Chem. 100 will be more available to health occ. students. In 2018-19 our head count was 1168. In 2021-22 it is 1419. The peak head count was 2020-21 when we had 1436. The college and division are down over that period. We have increased our course section offerings to meet demand. For example we have increased Chem. 110 from 7 sections to 9. We have increased Chem. 112 section offerings from 2 in the fall to 3. We have significantly increased our summer course offerings. We now offer Chem. 111 in the summer whereas we never have before.

With the exception of 2018-19, when our department went from 6 to 5 full-time faculty, our enrollment has steadily increased from 1334 in 2014 to 1732. This is a 30% increase, even as our full-time faculty had decreased from 6 to 5. We hired two new full timers (thankfully started Fall 2022) but only 6 are currently teaching (sabbatical). Our largest ethnic group by far is Hispanic. In 2014-2015 we had an enrollment count of 789 (59%) and most recently we are at 1201(69%). Our second largest ethnic group is Asian and that group has fluctuated slightly but is around 15%. The other ethnic groups are very close in percentage and have not changed much since 2014. Overall our enrollment trend in chemistry is upward even during the pandemic. In 2014-15 the chemistry department had 309 FTEs. By 2020-21 we were up to 411 FTEs which is a 33% increase in FTEs. The FTEs increase is coupled with an increase in sections. The chemistry department over that same period of time went from 95 sections to 142 sections. The largest increase came from Chem. 100. From 2014 to 2019 there were on average about 30 sections of Chem. 100 per year. In 2020-21 that number of Chem. 100 sections jumped to 54. That is an 80% increase in sections. In 2014-15 there were 30 sections of Chem. 110. In 2020-21 there were 40.

Here is a table that shows the current break down of teaching units in the chemistry department as to Full Time/ Overload and Part Time:
Fall 2022

	Teaching Units	% of Teaching units
Full Time Faculty Load	84 units	39.4 %
Full time Faculty overload	15 units	7.0 %
Part Time Faculty	114 units	53.5%

The college's process for hiring full-time faculty has severely failed at meeting the needs of the students of the chemistry department. Currently our number of full-time faculty is 7 and it is likely that for the next two years a faculty member will be on sabbatical. So our real number of full-time faculty is 6. Our enrollment has increased 30%. For the spring semester of 2022 we will have at least 17 adjunct instructors. The biology department also has 17 adjuncts but it has 8 full-time faculty. The Full-time Chemistry spend too much of their time interviewing new part timers and mentoring them to the level where they can maintain the level of student success. We want to maintain the quality of instruction. But we are having much difficulty finding quality part time instructors. The full-timers spend about 2 hours a week minimum, sometimes 4 hours, mentoring the part timers and holding meetings to help them prepare for lab. We need to make sure the part timers can safely perform the demonstrations in the lab! We also need to make sure the part timers are correctly explaining the material. This has been an

issue the last 6 years.

While we are very grateful that we were approved to hire 2 full time faculty starting Fall 2022, we have concerns with the FHP process and the number of full time faculty hired by the college. The college faculty hiring process does not serve our students well. The FHP prioritization is primarily based on the ratio of section numbers to FT faculty in a department. Section numbers can be misleading as courses can range from 1 unit to 6 teaching units. In the sciences, there is a limited pool of quality instructors for part time instructors and we struggle to staff classes. Due to this issue many of our students have been forced to go to other local community colleges for their transferable science courses. With the current process, our science students will continue to be pulled to other institutions that are able to offer additional sections of SEM courses.

In the current FHP cycle, Chemistry was ranked 25th. It is our understanding that the state of California has set a target of around 70-75% of sections to be taught by full time faculty load. If the Chemistry department is ranked 25th in need how can the college be anywhere the state recommendations. We strongly believe that our students are better served by full time faculty that are dedicated to the institution and available to students rather than part time faculty stretched very thin amongst 3-6 institutions to make ends meet. As a college we need to prioritize our students learning experience and success by investing in dedicated full time faculty. It is the faculty that teach the courses, connect with students daily and can make or break a student's success.

Discuss the program's success and retention rates, addressing any performance gaps if success rates are lower for disproportionately impacted students. Consider the following questions when writing your response:

- How have the success and retention rates changed over time?
- Are there particular courses that have particularly low rates and may prove a barrier to program completion?

Overall the success rate in the chemistry department was 68% in 2014-15. It peaked in 2019-2020 (68%) and then dropped to 62%. However, if we look at the sheer number of students that succeeded in 2014-15 (915) and compare that to 2019-20 (1169) and most recent (1067) we see an increase in the number of students that succeeded compared to 2014-15. The chemistry department is serving more students. Looking at retention rate we see a steady decrease over the six year span from 80% to 74%. But again the sheer number of students retained went from 1072 to 1289. Just prior to the pandemic we had a retention rate of 79% which included 1351 students retained.

The retention rate from Chem. 100 has dropped from a peak of 83% to 72%. Much of this drop occurred during the pandemic when all of our Chem. 100 courses went online, with the vast majority being asynchronous. Prior to the pandemic the enrollment in Chem. 100 was around 500. It peaked in 2019-20 at 571. In 2020-2021 the enrollment was 686. That is a significant increase in numbers. Many more students are taking Chem. 100. The retention number was 495. So chem. 100 is retaining the number of students it used to enroll. More students are staying in Chem. 100 than ever before. The success rate in Chem. 100 peaked at 75% in 2019-20 and previously fluctuated between 66% and 73%. In 2020-21 when classes were 100% online, the success rate dropped significantly to 61%. However, prior to 2019 the sheer numbers of successful attempts hovered in the mid 300s. In 2019-20 the number increased to 431 and only dropped slightly in 2020-21 (417). More students are taking Chem. 100, more are staying, and more are succeeding even though the overall percentage of success is **down from the last year**. Chem. 100 does not affect the other courses much since it is a terminal course.

Chem. 110 is the entry level to our 5-year chemistry sequence. The success rate of Chem. 110 was 63% in 2014-15 (261 successes) and trended downward to 2017-18 (56% and 288 successes). Just prior to the pandemic the success rate was 57% (321 successes) and during the pandemic the success rate was up to 58% (315 successes). The success rate in Chem. 110 has been U-shaped since 2014. Again the sheer number of students succeeding in Chem. 110 has been generally up. The enrollment in Chem. 110 has generally increased. In 2014-15 the enrollment was 417 and now it is 540. The retention rate has also be U-shaped. We are currently retaining 75%.

Chem. 111's enrollment has generally increased from just over 200 to now just below 300. The success rate in Chem. 111 hovers in the mid 60% range. The number of successes has increased. The number of successes had been in the 160s generally and now it is between 180-200 in the last two years. The success rate is generally in the low to mid 60% range.

In Chem. 112 the trend in success is generally downward. The percentage success in 2014-15 was 75% (117 successes) and in 2019-2020 it was 72% (127 successes). Prior to the pandemic the sheer number of successes had increased but during the pandemic the success rate was 62% (72 successes). This significant drop during the pandemic was due to the nature of the content of the Chem. 112 course.

In Chem. 211 from 2015 through 2021 the number of successes has remained fairly steady near 50 students succeeding. The success rate has been between 65-75% over the last six years. Chem. 212 has a success rate generally in the mid 70s to low 80% range. Generally around 30 successes.

What we see is that the higher the level of chemistry course generally there is a higher level of success.

Roughly 500 students start out in Chemistry 110. By Chem. 112 around 100 have succeeded. Around 30 make it all the way through to succeed in Chem. 212. Many of the students we serve do not need to take Organic Chemistry or second semester General Chemistry (CHEM 112).

If the chemistry department is going to sustain the kind of growth it has seen three things are desperately needed
1) More full time faculty
2) More lab space that is in close proximity to the stockroom
3) More classroom sets of lab equipment (including adequate cabinets for storage)

With regards to success and retention rates, what is the program doing or planning to do to close performance gaps and address student equity? Consider the following question when writing your response:

- Are there differences in success rates across delivery method (e.g., face-to-face compared to online)?

Review of the success and retention rates for our courses showed no disproportionately impacted groups suggesting an equitable learning environment. We are committed to and constantly working towards greater success for all students.

In 2019-2020 none of our classes were online. Across the department our success rate had seen a 3-year peak at 68% (1169 successes). In 2020-21 all of our classes were online. The success rate was 61% (1067 successes). In Chem. 100 the pandemic drop was from a 5-year peak of 75% down to 61%. Chem. 110 actually saw an increase during the pandemic from 57-58%, Chem. 111 dropped from 70 to 64, which was still higher than the years 2016-2019. Chem. 112 dropped from 72 to 62 during the pandemic. Chem. 211 increased and 212 decreased from 81% to 77%. Chem. 100 skews this data since it represents close to 700 students taking the course with 417 succeeding in the online environment. In 2014-15 only 440 students took the course. Going online definitely increased the department's enrollment. We were able to add more courses in Chem. 100, 110 and 111. We saw a decrease from 1169 right before we went online to 1067 being fully online. And the overall percentage of students succeeding in online classes was lower than any of the previous six years.

Looking at success rates for traditional vs. online instruction the chemistry department success rate hovers between 63 to 69 percent in traditionally taught courses. But the one data point for online courses shows a 57% success rate. The retention rate shows a roughly 7% difference. Nevertheless, the total number of students that succeeded in a chemistry class in 2014-15 was 915 and in 2020-21 was 1067. We have maintained the number of students that succeed if not the percentage that succeed. If we want to maintain or increase the percentage of successful students we need more well-trained full-time faculty.

Discuss conclusions drawn from the program data, assessments (SLOs), and/or other data. Indicate any specific responses or programmatic changes based on the data.

There has been much discussion amongst the California Community College system of a goal of 75% of courses being taught by full-time faculty. For the Spring 2022 semester the breakdown of our course instruction is as follows:

- 29% of chemistry course hours taught by full-time faculty load (update: 40% in Fall 2022)
- 9% of chemistry course hours taught by full-time faculty overload
- 62% of chemistry course hours taught by adjunct faculty

There has been an upward trend in enrollment in the chemistry department. We need more full-time faculty to maintain this momentum and sustain the growth. The current number of full-time faculty that are actually teaching is grossly insufficient to sustain the student needs. Over the past few years, the current faculty hiring process has been terribly inadequate to meet the needs of chemistry faculty. The department chairs are spending their time justifying the need for faculty when we could be doing things for students. While our student FTE have increased by over 30%, it took four years to hire a replacement for Cheryl Shimazu who retired in 2018! In year 2019, the chemistry department was approved to hire a replacement position. The job add was posted, applications were submitted but the college cut the number of positions it was hiring and the Chemistry position was withdrawn despite our continued growth and losing a full time faculty member. This has been an incredible disservice to our students, who need faculty that are present and invested in their success.

Our department has a tradition of mentoring adjunct faculty and improving their teaching so that they can give the highest level of instruction to our students. Usually our part-timers get hired on full time at another institution when we should have hired the best for ourselves. In Fall 2022 we even have 3 of our part timers that are full time at other community colleges! **Instructors** want to teach **chemistry at Cerritos College** because we take good care of our part timers. But what has happened during the last year is we have hired so many adjuncts so quickly that we do not have the ability to adequately mentor them in. We just stick them in a class and hope for the best. The reason for the growth in students and continued strong enrollment is due to the quality of instruction the students receive from the Cerritos College Chemistry Department. Over the last two years we have not been able to deliver that same quality due to the lack of full-time faculty. We see this most clearly in CHEM 100 in which the overwhelming majority of sections are taught by part time faculty, many of whom are new and have never stepped foot on the Cerritos College Campus. The students will soon learn that the thing that attracted them to Cerritos College, namely quality instruction, no longer exists as it once did. They know they can go elsewhere.

Another one of the main hindrances to growth, is our lack of laboratory space. During the COVID-19 pandemic, the Chemistry department has increased the number of sections it offers. We now face the challenge of returning our programs to campus and trying to continue to serve a larger number of students with an increased number of laboratory and lecture sections. Even prior to the COVID-19 pandemic, we faced increasing challenges in scheduling the increasing number of sections. **In addition to finding qualified and available instructors, the chemistry department is finding it difficult to fit all of the lab sections into the lab rooms.** If the chemistry department is going to continue to grow there needs to be more lab space on the college campus. An evaluation of laboratory space suggests we are near maximum functioning capacity and further growth of enrollment will be limited by on campus instructional space for laboratories and possibly lectures.

Curricular Course Review : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

Provide the curriculum course review timeline to ensure all courses are reviewed at least once every six years.
Here are my bullet points of the curricular changes we have made in CHEM 111 over the past 6 years. We have updated the SLO's

- Updated SLO in 2018 to better measure student success and learning for planning. More specific and new SLO's on critical topics.
- Laboratory experiments
  - Reviewed Course Outline in e lumen 2018 or 2019?
  - Updated labs and incorporated modern technology (Vernier Probes for T, pH, conductivity)
    - Reactions of Copper Experiment – added new skill vacuum filtration
    - Electrolytes and Conductivity – Updated experiment and added Vernier Conductivity probes
    - Molar Mass by Freezing Point depression – Updated experiment to use Vernier T probes to collect the Freezing point depression curves and export data to plot on computer.
    - Incorporated pH electrodes into the following experiments: pH and it's measurement, Ka of acetic acid, Reactions of Salt with Water
  - New Experiments
    - Ka of Unknown Acid – Titration using Vernier pH probes and analysis of graphed data
    - New buffer experiment -focusing on buffer preparation and how a buffer resists change in pH
    - Intermolecular Forces through evaporative cooling
- Lecture
  - Redistributed lecture content amongst 4 units to more evenly distribute course material amongst the 4 exams and place a greater emphasis on early critical topics such as nomenclature and formulas, writing chemical equations and stoichiometric calculations which are necessary to succeed later in the course. This brought the first exam earlier in the semester giving students a reference point and a high stakes assessment earlier in the semester.
- Response to COVID and ONLINE Instruction
  - Instruction moved to 100% online or hybrid
  - Lectures and Labs were synchronous when online to maximize student contact with instructor and peers
  - Many instructors ran flipped or partially flipped classrooms online
  - Students often had take home open note and book assessments and make explanatory videos etc.
  - Labs were converted to videos with data analysis and 4 at home experiments with household chemicals
- How curricular review occurs.
  - CHEM 111 instructors meet regularly both formally and informally to discuss how topics are taught and what is working well and where students struggle
  - New learning tools are created to support the areas where students struggle most and respond to the situation on the ground as the world around us changes.
  - New experiments were developed and evaluated collaboratively with the goals of incorporating modern chemical analysis instrumentation, providing students opportunities to practice hands on laboratory skills, improve data analysis and incorporating modern technology for data analysis.
  - Faculty will be reviewing Course outlines in 2022 to look at how content is distributed between CHEM 110, 111 and 112 and to increase student learning and success and to make sure we are in compliance with new guidelines from the state.
- Chem. 211 and 212 updated 211 and 212 Course Outlines, which were then approved by the Curriculum Committee, Board of Trustees, and Chancellor's Office in May 2019
- We added this statement to the lab section of the courses Chem. 111, 112, 211, and 212 "If the course contains an online component, there will be required on campus meetings for hands on laboratory experiments." We added this statement to Course content Lab content section and Methods of instruction section.
- For Chem. 211/212 we changed the textbook to OER. (Text Author: John McMurray Organic Chemistry 10th ed.)
- For Chem. 110 and 111 we added this line to methods of instruction: "Lecture videos are to be viewed before coming to class to support flipped classroom activities." We also added in methods that there may be a flipped classroom with this statement: "Students will apply concepts from lecture videos to solve chemical problems and explain chemical phenomena while working in groups."
- Text book editions for Chem. 111/112 were updated to 6th edition of Nivaldo Tro.
- To Chem. 112 we added an advisory statement (mandatory revision) Of taking Math 155. We performed course mapping between Math 155 and Chem. 112. "It is advised that students take Math 155 prior to Chem. 112."

Explain any course additions to current course offerings.
Currently we (Linda Waldman) have submitted to curriculum a new course for general education students. This is a consumer chemistry course designed for non majors. The goal is to open up more space in Chem. 100 for our health **occupation**. students.

We are in the very early stages of creating a chemistry technician program. We want to provide well trained workers for the local chemical industry in Southern California. **This will be a very expensive and hands-on lab intensive program.** The goal is to provide certificates to students that complete a sequence of chemistry and technology courses.
Explain any course deletions and inactivations from current course offerings.
Chem. 105 was a course developed to meet requirements of teacher TRAC students that were transferring to CSULB. At Long Beach there was a physical science course that had too little chemistry. At the time the requirements for science were higher than now. The Chem. 105 course is no longer required at CSULB and hence there is no student demand for a 1.5 unit chemistry course.

We will also be deleting Chem. 95 which was a tutoring course. We have so many good student tutors for our students now and we need all of our instructors in our regular chemistry courses: 100, 110, 111, 112, 211, 212.
Discuss how well the courses, degrees, and/or certificates meet students' transfer or career training needs. Consider the following questions:

- Have all courses that are required for the program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?
- How has degree and/or certificate completion changed over time?
- Are there sufficient completers compared with the size of your program?

We offer all of our courses every semester. In the summer we offer Chem. 100, 110, 111, 112. There have been a significant number of course offerings over the last few years.

Section Counts in Chemistry	2011-12	2020-21
Overall	86	142
Chem. 100	23	54

Chem. 110	38	40
Chem. 111	16	26
Chem. 112	12	8 (14 in 2019)
Chem. 211	7	7
Chem. 212	5	5

We have seen an increase in demand for Chem. 100. This course supports the health occupations programs. We have also seen an increase in demand for Chem. 111 (and hence 110) due to the increase in engineering students. As mentioned before, chemistry is largely a "support department". We support biology majors and engineering majors and health occupation majors. By increasing the opportunities for summer research and industry internships we believe we can also increase the number of chemistry majors and chemical technician certificate holders.

Are any licensure/certification exams required for program completion or career entry?

- If so, what is the pass rate among graduates?
- Set an attainable, measurable goal for pass rates and identify any applicable performance benchmarks set by regulatory agencies.

No

Program Reflection

Six-Year Program Reflection : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

Provide an analysis of your program throughout the last six years, reflecting on student demographics and enrollment. Reflect on any changes you would like to see in your program in the next six years.

Changes we have seen:

- Increase in sections from 107 to 142. **(33% increase)**
- Increase in FTES from 357 to 411. **(15% increase)**
- **Significant** increase in enrollment Chem 100 and 111 so it's easier for our biology and engineering students to get through.
- Teaching Chem. 111 in the summer
- **Added** 3 replacement faculty and 1 growth position (Moskun, Bonness, Cooke, Chen.)
- Loss of Olga Dukhovny and replacement by Rachel Moran

Changes we would like to see

- 2 more full-time growth positions
- Chemistry technician Certificate with new course offerings such as instrumental analysis
- New consumer chemistry course
- Investigate OER. (Open Educational Resources)
- Build partnerships with local chemical companies to provide internships for our students
- Full time stockroom person to support night courses and possibly weekend (Someone who gets a key)
- Increased resources for chemical instrumentation and analysis equipment FTIR (Fourier Transform Infrared Spectroscopy), GCMS (Gas Chromatography-Mass Spectrometry), HPLC (High Performance Liquid Chromatography), and NMR (Nuclear Magnetic Resonance Spectroscopy).

What is the six-year trend of degrees and certificates awarded? Is there anything you can do to help increase the number of students who acquire degrees and/or transfer?

- Chemistry has few actual chem majors. Most students that take chemistry are biology or engineering majors. Chemistry is generally a support subject. Nursing and other Health Occupation majors are required to take Chem. 100. Of the 142 sections of chemistry in 2020-21 54 or 38% were Chem. 100, which is a terminal course.
- We would like to see more chemistry majors! Our plan and direction is to show students the opportunity in **the chemical industry**. We have already begun to form partnerships with local chemical industry businesses to help provide internships for students as well as educate faculty and students about what jobs exist in chemistry.
- We had a chemistry job fair in 2019 to help students see opportunities in chemistry.
- We plan to start a certificate program for chemical technicians during our next program review cycle.
- We have built partnerships with local universities that take our students for summer research experiences. USC is taking 6 students in the summer of 2022. We hope this will build the number of chemistry majors.

Were there any unplanned events (positive or negative) that affected your program? If so, what were they and how did they affect the program?

- Sean Bonness and Amy Moskun were hired in 2016. They have been a fantastic addition to the chemistry team. They are excellent instructors and Amy is now the Co-department chair.
- Retirement of Cheryl Shimazu in Spring 2018. We will not see a replacement position start teaching until Fall 2022. It took four years to replace this full time position. During this time the the section count went from 124 to 142. This loss of a position put a strain on the rest of the faculty with fewer people to carry a larger load.
- Loss of Olga Dukhovny (Stockroom Technician) In the Fall of 2021 our stockroom technician moved to Florida. This happened right as we were moving back onto campus after the pandemic. We went for a semester with the stockroom run by students and faculty.
- Loss of many part time faculty to full time positions at other campuses. During this time many of our very best part timers were hired on other campuses. This means the full time faculty had to recruit, hire and mentor new part timers.
- Hiring Rachel Moran as new stockroom technician. Rachel has been a fantastic addition to our team. She is making some much needed changes. And she brings a tremendous amount of energy and creativity to the stockroom.
- Increase in the number of sections. From 2015-2016 to 2020-2021 our section count went from 107 to 142, a 32% increase. It is wonderful to be able to offer more sections so that more of our students could get on with their lives. But this increase in sections was not met with an increase in full-time staff. So the load on full timers as to responsibilities outside the classroom became unsustainable.
- Sabbatical of Linda Waldman 2021-2022 and Rena Lou 2022-2023. It is nice that our faculty could take a sabbatical, but at the time of Linda Waldman's sabbatical our faculty was at its lowest number since the 1950s and our enrollment was the highest ever. For the first time ever we had a part time instructor, Kevin Chen, coordinate a chemistry course, Chem. 100.
- Increase in the number of part time instructors. In Fall 2004 6 part time instructors taught chemistry courses. In Fall 2016 12 part timers taught chemistry courses and in the Fall 2022 there will be 18 part time instructors all while the full time count has been between 5 and 6 faculty. We have enjoyed mentoring many faculty over the years and are happy to say that several are now full time faculty throughout California. But the constant recruiting, hiring and mentoring of these faculty has taken its toll on the full timers. It is common for a full timer to spend 1-2 hours per week with a new part timer.
- Covid-19 and the move to completely online courses. We all know what happened in 2020. Most of our faculty have received a distance education certificate. We have all learned a great deal about teaching online and using Canvas and Zoom. Many of these skills will be utilized as we go forward. But this process has taken a toll on the education of our students. We saw a significant drop in success rate in our department. In 2019-2020 the department had a 68% success rate. In 2020-2021 the chemistry success rate was 62%. The Chem. 100 success rate went from 75% to 62% over that time and the Chem. 112 success rate went from 72% to 62%.
- Move to hybrid courses
- Moving back to campus. In Fall 2022 the vast majority (>90%) of our courses were on campus and in person. We have a couple of Chem. 100 sections that are online.

Please describe any recent achievements in your program by faculty and staff who have won awards or distinctions, new projects your program has implemented, committee work, professional development work, conference presentations, community engagement, or recently published work.

- Outstanding Faculty 2017
- 8-10 students per year have performed research at USC, Univ. Washington.
- Served on:
    - Teacher TRAC Leadership Team
    - Sabbatical committee
    - FHP committee
    - Technology-based learning committee
    - Academic Excellence Awards Committee
- The department held a Chemistry Job Fair
- Mentoring in Be-Stellar Program
- Leadership in National Chemistry Week
- Leadership in Steve Luther Science Night for Southern California
- Formed partnerships with local chemical companies and helped place students
- Had several guest speakers from USC chemistry department and former students who have obtained Ph.D.'s in chemistry and local industry.
- Sabbatical projects including creating online General Education Consumer Chemistry/Liberal Arts Course and also a database of chemical demonstrations.
- Partnered with the American Chemical Society to giving feedback on their curriculum materials such as safety.
- Advising clubs e.g. Biochem club, ASET club, Christian Students at Cerritos club
- Faculty members in our department have earned the Full Online Teaching Certification through 25 hours of professional development.
- Chemistry job fair on campus October 2019.

Provide a status update on goals from the last program review cycle.

Goals

The abbreviations for faculty names used below are: JB = Jeff Bradbury, SB = Sean Bonness, RL = Rena Lou, AM = Amy Moskun (or other new faculty), CS = Cheryl Shimazu, LW = Linda Waldman, Olga = stockroom manager (Olga Dukhovny), Coordinator = whoever the current **faculty** coordinator of that course is and Chair = whoever is the current chair.

Ref	Goal	Action to be Taken	Steps	Date	Person

W1, W3, T10, O3	Investigate and develop means to improve student success in Chem 110. 4	Research fifth unit in Chem. 110 Update: We spend more time on this goal than any other over the last 5 years. We had extensive conversations about making Chem. 110 5 units (4 hours lecture and 3 hours lab). Many surrounding schools have a 5 unit preparatory chemistry course. We have chosen not to do this. The main reason is that it would create a situation where the number of teaching hours would prohibit our faculty from maxing out on their teaching load. Currently we offer 8 sections of Chem. 110 each semester. Adding one teaching hour would make it impossible for full-time faculty to reach 21 units and adjuncts to reach 9 units. We have decided to consider changing Chem. 110 from 3 hours lecture and 3 hours lab to 4 hours lecture and 2 hours lab or 3 hours lecture, one hour discussion/problem solving and 2 hours lab. We are going to wait on the college's decision on a 16 week calendar before we end up making this transition twice.	Investigate to see whether getting a 5-unit course will help student success.	Fall 2017	RL
			Investigate which schools in our area have a 5 unit Chem. 110 and which do not?	Fall 2017	RL
			Ask the other schools what is the success rate at the schools that do have a 5 unit Chem. 110	Spring 2018	RL
			Compare rates of success and completion for various chemistry 110 unit courses.	Fall 2018	RL
			Find out what do these schools do with the time for that fifth unit.	Spring 2019	RL
		Research to see if we need to increase math prerequisite Update: We researched other schools and found they have the same prerequisite slaldkfj	Request more data that relates student success and completion in Chem 110 to their prerequisite math courses in math.	Fall 2017	CS
			Evaluate data to correlate math level with completion and success in chem. 110	Fall 2018	RL
			Investigate whether other schools have a higher math prerequisite and how that affects success	Fall 2017	RL
			Correlate the success and completion rates at schools have a higher math prerequisite and compare to our school.	Fall 2017	RL
		Learn about our students through surveys Update: We did not do this we did not have the staffing or time. Cheryl Shimazu retired leaving us short handed for 4 years and she was the main survey champion. Alternatively we added embedded tutors to almost every single chemistry class. Based on student feedback the embedded tutors improved student satisfaction. During the time of implementation of embedded tutors the departmental success rate went from 63% in 2017-18 to 68 % in 2019-20 right before the pandemic. So at least the addition of embedded tutors to our courses correlates with a bump in success. We are not claiming it is the cause of the bump of success. The chemistry department has a very highly organized and coordinated embedded tutoring program. In spring 2022 there were 25 embedded tutors, There is an excellent relationship between the department tutoring coordinators (faculty) and the student success center. This has taken a great deal of time and energy and been a major project. We have been fortunate to have very good embedded tutors that are excellent role models/peer mentors and inspiration. The tutors benefit by having the content solidified and learning deeply by communicating difficult chemistry concepts to a diverse student population.	Come up with ideas/ questions for surveys	End of Fall 17	CS
			Write survey questions and conduct preliminary survey	End of Spring 18	CS
			Administer pre-post surveys	Pre-post per semester for 2 years	CS
			Compare success rate of students that have had prior chemistry (chem. 100, high school chem. Previous chem. 110) to those that have not.	End of Spring 2020	SB
			Analyze survey data	End of Spring 2020	CS/SB/AM
		Learn about students through exams and quizzes comparing 2 courses (110 and 111). Update: This is still in progress in process of accessing scores from all chem. 110 and 111 instructors so we can do the analysis.	Collecting data (110 quizzes, 110 final exam grades, 111 quizzes and exams that are reviews).	Each semester for 2 years	SB
			Use 3 data points on dimensional analysis/stoichiometry (first taught, 110 final, 111)	Each semester for 2 years	SB
			Analyze student work and look at most common student mistakes is there a “silver bullet” that could improve scores.	End of fall 19	SB
			Try to find the “predictor” of student success or failure in chem. 110.	End of Spring 20	SB
		Correlate SLOs to success Update: Please see the above narrative on our assessment of SLO data, particularly as it applies to Chem. 110. We have had extensive conversations regarding Chem. 110 SLO data. This has led to significant increase in coordination and mentoring of the many part timers that teach Chem. 110. For example, the Chem. 110 **faculty coordinator** meets with the adjuncts teaching the course at least one hour per week. The **faculty** coordinator reviews the part timers exams and they discuss grading and student performance extensively.	Select SLOs that are student success indicators.	End of Fall 17	JB
			Write SLOs that incorporate student success indicators.	End of Spring 18	JB
			Discuss when we want to collect SLO data (at different times or only on the final?)	End of Spring 18	JB
			Collect data on revised SLO’s.	End of Spring 19, and annually thereafter.	JB/coordinator
			Analyze how new SLO performance correlates with grades and student success.	Fall 2022	JB
			Analyze the main SLOs that are causing student failure and develop strategies to improve success.	Fall 2023	JB

		Improve training of adjuncts Update: We meet with adjuncts regularly to discuss safety, lab procedure, exams, student performance and many other issues. Due to the growth of the number of adjuncts and the turnover in adjuncts due to many being hired full time elsewhere we are hiring and training sometimes 3 to 4 new instructors each year in Chem. 110	Collect a list of misconceptions or common errors for all 4 slo's and use this to train our adjuncts and improve our lecture outlines.	Fall 2017	JB/coordinator
			Give adjuncts a list of common errors and how to teach to help students improve which becomes a preventative procedure	Fall 2018	JB
		Computer programs and technology Update: Chem. 110 nomenclature and titration simulations have been fully edited and incorporated into our Chemistry 110 courses. We have received resources to purchase and incorporate Vernier Technology into our Chem. 111, 112, 211 and 212 courses. For example we have received and began to use pH probes, temperature probes, spectrophotometers, gas chromatographs that we use extensively in our courses. We have received new iPads as of 5/2022 that we will be incorporating into our courses During the pandemic we started using PHET **(Physics Education Technology)** simulations in Chem. 110 and some in 111 and 112. We found these to be very good and helpful. We would like to continue to best utilize these simulations as we come back onto campus.	Edit 110 nomenclature & titration labs as needed.	Fall 2017	RL
			Research ways to use iPads and computers more and if we add a fifth unit use them in discussion.	Fall 2020	JB
			Incorporate Vernier technology into the 110 labs.	Spring 2018	CS
W2 W4	Determine if Chem. 105 should be scrapped, rewritten or left alone.	Align chem. 105 with current NGSS **(which stands for the grades K-12 Next Generation of Science Standards)** standards and find the correct number of units for student needs. Update: Scrapped Chem. 105	Meet with new Teacher TRAC coordinator to discuss future **enrollment** and needs for a Chem. 105.	Fall 2017	JB
			Meet with Cal State Long Beach Science education faculty to discuss chem. 105 future	End of Spring 2017	JB
			Research NGSS standards	Fall 2018	JB
			Make a decision about Chem. 105: Either rewrite chem. 105, if needed. Or remove class from catalog if needed.	Fall 2020	JB/LW
W2 W4 T1	Maintenance/ replacement/ acquisition of equipment (in coordination with the stock room)	Have a single form to request for equipment Update: Most recently we have used the department unit action plan and did this process more on an ad hoc basis. We meet regularly with the dean and Stockroom technician who involves us in the budgeting process. It might be good to develop a Google doc but would we start it and not maintain it?	Create desired/needed equipment form that includes links to requested items and contacts for quotes. Keep on Google Drive/Google Docs for all departmental members to access and edit.	End of Fall 2017	LW/Chair
			Review as department to prioritize needs	Annually, for DUAP	LW/Chair
		Develop a plan for maintenance (e.g. analytical balances) Update: We purchase balances when money is available and the department chairs and stockroom technician deem it necessary	Inventory current instrumentation in Google doc. Include maintenance needs in inventory (Call companies if needed)	S 2018	AM/Olga
			Assign point person for each piece of equipment and include in inventory list	S 2018	AM
		Replacement schedule Update: The chemical inventory is done through the stockroom. The stockroom technician keeps tabs on our equipment.	Contact manufacturers for expected lifetime of each type of equipment.	S 2018	AM
			Keep a running Excel/google doc log of purchased equipment, expected lifetimes and anticipated replacement dates and costs (update/review annually).	Monthly	LW/Chair
			Keep a running log of equipment that needs to be replaced due to damage. All of department can edit and discussed at dept. meetings.	Monthly	LW/Chair
		Building maintenance Update: We communicate as needed with facilities to fix the room. The division has a streamlined process for dealing with building maintenance.	Course **faculty** coordinator takes care of the room in coordination with the stock room	As needed	All Coordinators Olga
			General maintenance requests for Building/ bathrooms doors etc.	As needed	LW/Chair

W3 O3	Scheduling for departmental courses	Know our students (their schedule, etc.); better understand our student population Update: We have significantly increased the number of sections offered for Chem. 100, 110, and 111. In **2020-2021** we offered 142 sections up from 86 in 2011. We have significantly increased the number of summer sections we teach. We are attempting to offer a Chem. 110 during the second six weeks to better meet the needs of students that just graduated from high school. But this depends on if we can find the faculty to teach it. We are in constant conversations with the dean over the best times to offer our courses. Due to increased number of part timers relative to full timers and the loss of and lack of replacement of full timers we have not had time to take on this project. As to the surveys Cheryl Shimazu, the main person behind the surveys retired. **We do not plan on using surveys at this time to learn about our students. However, the student-tutors have been an excellent source of "eyes and ears" to help our faculty understand the needs of the students.**	Develop student survey to determine our "majors" needs	yearly	CS
			Develop student survey to determine number of attempts students have made before entering majors sequence and nursing chemistry classes	yearly	CS
			Analyze data from surveys	yearly	CS
			Correlate surveys + success data	End of Spring 2018	CS
			Correlate surveys with major requirements (chemistry course requirements for their majors)	End of Spring 2018	CS
			Follow a pipeline of students to see how long program actually takes	End of Spring 2018	CS
			Determine the % of students that actually move from 110 to 111 and 111 to 112 and 112 to 211 and 211 to 212.	End of Spring 2018	CS
			Develop a mathematical formula to help predict future course offering need approximately 2-3 semesters based on average data.	End of Spring 2018	CS
			Look at balancing course offerings annually courses from various angles.	End of Spring 2018	CS
		Increase our Adjunct pool Update: We went from 6 adjuncts in 2004 to 18 in 2022. Be careful what you set as your goal! In the Spring of 2022 we have almost a 4 to 1 adjunct to full timer ratio! The need to constantly replenish adjuncts and adequately train new adjuncts is consuming much time and resources!	Reach out to local universities. Develop contacts in local universities (CSULB, CSUF, UCI, etc.). Identify community college teaching programs	Continually	LW/All
			Request PT faculty availability earlier	End of Spring 17	LW
		Increase the number of full time faculty Update: We now have 7 full time faculty except that they keep going on sabbatical! And we are requesting two more. So in the Fall of 2022 we will still only have 6 full time faculty teaching which is the same as the last 50 years.	Write a faculty request with data from surveys	Fall 18 and annually	LW

If applicable, describe the resources the program received from the last review cycle and the impact it had on the program?

- Three replacement faculty and one growth position. (Moskun, Bonness, Cook, Chen) They have been a fantastic addition to our chemistry team and are breathing new life and creativity into our department
- New, supportive Dean. (Vines)
- iPads - We recently received two class sets of i-Pads to replace our sets that were about 10 years old to support student learning and visualization.
- Rachel Moran replaced Olga Dukhovny as our stockroom technician.
- Vernier equipment. We have made significant purchases in Vernier Technology Chemical proves to support our laboratory courses. This has led to several new lab experiments and updating of many other experiments. Students are learning to use and care for modern chemical probes and to collect and analyze digital data sets. As a result they are better prepared to work in upper level laboratories when they transfer or in industrial or research laboratories.

Resource Requests

Faculty Resource Request(s) : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

We requested

1. In May 2022 we will be requesting 2 new faculty (growth positions) for the chemistry department. Even though we have hired two new positions this current year we are still under staffed. In 2004, for example, **the** chemistry department offered 38 sections (41 if Chem. tutoring is counted). 34 (83%) of those sections were taught by full timers and 7 were taught by part timers. In the Fall of 2022 the chemistry department will offer 64 sections, 26 of which (40%) will be taught by full timers. Even though we have hired 2 new full time faculty we will still be hiring more part timers. The number of sections between 2004 and 2022 has grown 68%. The department is continually needing to find more part timers. The nature of chemistry instruction is that the new faculty need to be mentored which takes a great deal of time. We would like to get to a place where we can maintain a reasonable amount of part-time faculty and have time to complete our other goals. The process of justifying the need for full time faculty and hiring them and also hiring new part time faculty is hindering our growth and student success. While the college enrollment has decreased some 25%, the chemistry department enrollment has increased by about 30% since 2017.

Program/Department/Division:
Chemistry/SEM
Title of instructor position:
Instructor of Chemistry (Full-time) 2
Part-time faculty
Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

1. Faculty member 1Critical (mission critical or must have)
2. Faculty member 2 Important to support current increased enrollment and increased courses necessary for certificate programs.

Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary

- Conversion (grant to general fund)

We are requesting two growth full-time faculty positions.

Cost estimate:
$ 450,000 . But we bring in a lot more!! $ 2,000,000.00 when we look at our FTES
Occurrence:

- Recurring expense
- One-time augmentation

Permanent salary
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

General Fund.
Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.

- **The chemistry department is requesting two growth positions.**
- **For 50+ years the chemistry department has had six full-time faculty. Even though we hired two new full time faculty, we will still have six full time faculty teaching in Fall 2022. In 2004 we had six full time faculty teaching 34 (82%) sections and 6 part time faculty teaching 7 sections. In the fall of 2022 the department will have six full time faculty teaching 26 sections (40%) and 18 part timers teaching 38 sections. The department is upside down with regard to the ratio of part time vs. full time.**
- **Increased FTES/year from 309 - 411 over six years, a 33% increase while our full-time faculty have decreased.This corresponds to an annual revenue increase to the college of over $500,000/year.**
- **Many of the part timers get hired on as full time instructors elsewhere. In addition, the department has grown significantly in number of students and sections. This requires the department to constantly be recruiting and hiring and mentoring new part time faculty.**
- **Heavy teaching load and the responsibility of maintaining part time faculty and mentoring part time faculty makes it very difficult for full time faculty to complete critical projects like updating content, especially related to our outdated safety curriculum and training. Increased responsibility outside the classroom is spread out over fewer full-time faculty. Due to the necessity of maintaining part time faculty the department has not been able to complete critical goals, like program mapper, in a timely manner. We have had to put on hold curriculum updates and starting the chemistry technician program. This current ratio of part time to full time faculty is not sustainable.**
- **Chemistry supports biology, engineering and nursing programs, in which demand for chemistry has grown dramatically. The engineering department recently requested an increase in majors-level chemistry courses.**
- **Full-time faculty teach both summer sessions as well as maximum (and even excess/>140%) overloads, leading to extreme burnout.**
- **Students cite waiting up to 2 years to get into chemistry classes and go to other campuses.**
- **STEM disciplines have unique responsibilities outside their classroom such as coordinating lab courses and associated instructional resources, maintaining safety and required training of part-timers and students.**
- **Increased FTES from 309 to 411 (over 33%) in 5 years, while the college decreased 7%**
- **Increased successful completers in chemistry courses 915 - 1067 over the past 5 years**
- **Alleviated disproportionate impacts in chemistry while increasing enrollment.**
- **Greater than 95% course fill rate**
- **Addressed need for full-time faculty in past 5 Unit Plans.**
- **62% courses taught by part-time faculty, 9% overload**
- **Upper level courses have suffered loss of full time faculty. Inability to adequately staff CHEM 112, 211 and 212 courses is preventing students from matriculating.**
- **Local industry is expressing increased demand for chemically trained workers. To meet demand more chemistry degrees are needed.**
- **CTE chemical technician certificate on hold until adequate full-time faculty can support.**
- **Chemistry faculty frequently teach above the contractual 21 unit maximum. Many part-time faculty have taught 12 units/semester to meet demand and ensure access.**
- **Many of our mentored part-time faculty are now full-timers elsewhere, a handful were former students which could have been here full-time! Recently, long-time part-timers retired. Unending need to train new faculty. Chemistry lab requires much training especially in safety. Frequent hiring and mentoring of part-timers overwhelms full-time faculty.**
- **Hiring part-time chemistry faculty is incredibly challenging. Most applicants are not qualified, putting increased burden on process.**
- **Chemistry courses are only cancelled when unable to be staff which happened in Fall 2021 with two dropped sections. (>8 FTES lost)**
- **No capacity to deal with emergencies or sabbaticals or our recent loss of a stockroom technician. Most faculty are at the maximum contractual load.**

Hiring Justification Fall 2022
Your rational should include all that apply: The need identified in the annual planning process; health and safety regulations; enrollment trends; the need of a full-time position to support college priorities; professional standards; difficulty hiring part-time faculty, other. (0-5 points) (250 word max). *

The Chemistry department has grown significantly in the number of students and adjuncts, but Full-time faculty growth is not keeping up. Full-timers are teaching 40% of course sections in Fall 2022 down from 83% in 2004.

- In Fall 2004 there were 6 Full-time instructors teaching 34 sections and 7 part-time instructors teaching 7 sections.
- In Fall 2022 there will be 6 Full-time instructors teaching 26 sections and 18 part-time instructors teaching 38 sections. That is a 440% increase in sections taught by part-time instructors. The number of part-time instructors increased 157%. In Fall 2022 we will have a 3 to 1 part time to full time instructor ratio.
- In Spring 2022 15 of 61 chemistry sections or 25% were taught by full timers. When looking at surrounding community college campuses we found that an average of 60% of sections are taught by full timers on those campuses.

- The number of section counts in 2011-12 was 86 and in 2020-21 it was 142, a 65% increase. Summer offerings have increased significantly (460%) from 7 sections offered in summer 2011 to 39 sections in summer 2021
- The enrollment count has gone from 1369 in 2011-12 to 1731 in 2020-21. This is a 26% increase in headcount. Over the same period the FTES went from 334 to 411 a 23% increase.

- It is difficult to maintain the part time teaching pool. We are constantly needing to emergency hire new adjuncts. After the scheduling process began **between** Spring and Fall 2022 at least 4 adjuncts obtained Full time positions. Chemistry courses are only cancelled when we are unable to staff them. This happened in Fall 2021 with two dropped sections. This may happen again in Fall 2022 as we already have lost scheduled part timers to other institutions.
- We have found over time that students succeed better when they have the same instructor for lecture and lab. Because we have been stretched thin, we are maximizing part timers to nine units and splitting lecture and lab between different instructors in order to cover all of the added sections.
- We addressed the need for full-time faculty in past 5 Unit Plans.
- No capacity to deal with emergencies or sabbaticals or our recent loss of a stockroom technician. Most faculty are at the maximum contractual load.

- Unending need to train new faculty. Chemistry lab requires much training especially in safety. Frequent hiring and mentoring of part-timers overwhelms full-time faculty that needs to spend time on other projects such as program mapper, updating curriculum, designing certificate programs and forming partnerships.
- Greater than 95% course fill rate

In addition to a brief history, your rationale should include all that apply: Certificates, AA Degree, majors, and the impact on student success and needs. Please provide specific evidence when possible (i.e. department enrollment is up 25% over the last two years, we award 100 degrees every year) (0-5 points) (250 word max). *

- From 2011-12 to 2020-21 Chemistry Increased successful completers in chemistry courses 970 - 1067 as more students took chemistry, but the percent success rate decreased from 70.9% to 61.6%. We attribute part of the decrease in success rate to the instability and transience of so many part timers that require constant replacement, training and mentoring.
- We **are making** make some progress in **the Fall 2022** with the hire of 2 new full time faculty this increases the percent of courses taught by full time faculty to 46% still well below the 70% target set by the state.
- The department believes it could continue to add sections especially in Chem. 100 which is a support course for biology and health occupation programs as well as Chem. 111 which is a support course for biology and engineering programs.
- The chemistry department would like to create a Chemical Technician Certificate program. We have received requests from local chemical businesses that they would like to employ our students!
- The chemistry department supports many of the colleges priorities and programs and wants to increase the number of engineering students and certificates. We are often requested by the Engineering faculty to open more Chem. 111 sections.
- The chemistry department is continuously hiring and replacing and training new adjuncts. Due to lab safety concerns and coordination of lab, adjuncts require much mentoring. Mentoring of part timers is necessary for student success and safety. The volume of required mentoring is straining the full timers and keeping us from other much needed projects such as program mapping, developing the certificate and developing partnerships and curriculum updates. In Spring 2022 four of our part timers obtained full time positions after the schedule for Fall was created.

If this position is not filled, what is the potential impact to student success?
There already has been a significant drop in departmental success rate in Chem. 100 and 212 because we are using part-time instructors.
Chem. 100 has seen a 15% drop in success rate.
Chem. 110 has been holding steady
Chem. 111 has been going up and down
Chem. 112 has seen significant decrease in success 10%.
Chem. 211/212 goes up and down.
Overall department 6 % drop in success rate.
If we do not get adequate full time faculty we will not be able to spend our time on projects such as developing the chemistry technician certificate and developing partnerships with local industry and developing internships.
If we do not get adequate full time faculty we will not meet the student demand for courses

Classified Resource Request(s) : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

We have hired a wonderful replacement Stockroom **Technician.** Due to the growth in our program and the large number of hours/week (70 hours/week) that we are running labs we are also requesting a second stockroom technician position.

In the fall of 2019 we ran 8 sections of Chem. 100 on campus. In the fall of 2022 we are running 11 sections of Chem. 100, which includes 8 - 18 week on campus sections, 2-15 week on campus sections, and 1 online section. This is a 40% increase in sections. We also have increased the number of Chem. 110 labs from 7 to 9 and the number of 111 and 112 sections have increased as well. This has put a strain on the stockroom personnel. We currently have been limited to 5 student hourly workers in the stockroom due to limited funding in the SEM division budget for student hourly workers. There are many times during the week when there is a lab class going on but there is no student worker in the stockroom. There have been issues and lost instructional time as a result. This is unacceptable. We are requesting a new classified position for the stockroom for the evening lab classes in addition to increased student hourly budget.

Program/Department/Division:
Chemistry/SEM
Position requested:

Full-time Night Staff for Stock Room	1	50k/year	Important	GOAL F: Enhancing organization effectiveness	Due to the number of labs running at night (and possibly on Saturdays in the future) we need a permanent employee present to coordinate labs. This person would also be able to perform prep work during their night shift, supervise the student at the stockroom window, handle complicated questions from instructors, and assist in paperwork. Student workers often have changing classes/other conflicts semester-to-semester that make their schedules too inconsistent to fulfill this role. In addition, training a new student every 2-4 years to complete the detailed work proposed for this position is not efficient. With the department expanding rapidly, this role will only become more necessary every semester. Other community colleges with similar class loads have 2-3 full time employees to cover the number of classes we are now offering.

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Full-time Night Staff for Stock Room	1	50k/year	**Important**	GOAL F: Enhancing organization effectiveness	Due to the number of labs running at night (and possibly on Saturdays in the future) we need a permanent employee present to coordinate labs. This person would also be able to perform prep work during their night shift, supervise the student at the stockroom window, handle complicated questions from instructors, and assist in paperwork. Student workers often have changing classes/other conflicts semester-to-semester that make their schedules too inconsistent to fulfill this role. In addition, training a new student every 2-4 years to complete the detailed work proposed for this position is not efficient. With the department expanding rapidly, this role will only become more necessary every semester. Other community colleges with similar class loads have 2-3 full time employees to cover the number of classes we are now offering.

Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary
- Conversion (grant to general fund)

New
Cost estimate:
$50,000?
Occurrence:

- Recurring expense
- One-time augmentation

Recurring

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

General (program 100)

Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.

This position supports the lab portions of all chemistry courses. The stockroom should be manned by a permanent staff member any time labs are running for safety and liability reasons. Due to the number of labs running at night (and possibly on Saturdays in the future) we need a permanent employee present to coordinate labs. This person would also be able to perform prep work during their night shift, supervise the student at the stockroom window, handle complicated questions from instructors, and assist in paperwork. Student workers often have changing classes/other conflicts semester-to-semester that make their schedules too inconsistent to fulfill this role. In addition, training a new student every 1-2 years to complete the detailed work proposed for this position is not efficient. With the department expanding rapidly, this role will only become more necessary every semester. Other community colleges with similar class loads have 2-3 full time employees to cover the number of classes we are now offering.

If this position is not filled, what is the potential impact to student success?

Without a second qualified staff member in the stockroom, the number of lab sections the chemistry department can run will be limited. Having a permanent, trained and qualified stockroom technician present at all times while labs are running **ensures** that there is a second person available in case of an emergency or accident in the laboratory. Often our night courses are taught by part-time faculty. Some times there may only be one lab section running at a time meaning only 1 responsible campus employee on the floor. If an accident were to happen, for safety reasons there should be a second responsible adult present.

Other Staffing Resource Request(s) (e.g., Manager, Confidential, etc.) : Version by **Moskun, Amy** on **11/14/2022 04:06**

Additional Student hourly workers for stockroom. At the start of Fall 2022 we did not have adequate student workers. The stockroom was unable to check out equipment to Chemistry students several times. This caused significant problems to instruction.

Student worker to specifically assist with relabeling, lab kit prep, and clean out of storage areas	1	15/hr	Important	GOAL E: Upgrading educational infrastructure	The outdated labels on bottles (~1600) need to be replaced, lab kits for Chem. 100 need to be assembled, and there are various storage areas with old papers and equipment that must be organized. These are all simple, but time-consuming tasks that a dedicated student worker (not necessarily in chemistry even) would be very helpful in completing. Additionally, it is not safe for anyone including our stockroom technician to work in a chemistry lab alone. There should ALWAYS be a second person in the stockroom when any chemicals are be handled or prepared. We are running over 60 hours of labs a week and we need student hourly workers available to support all of these courses in additional hours for students with more training to assist our technician in preparation and switching out the experiments in the labs.

Program/Department/Division:

Chemistry/SEM

Position requested:

Student hourly workers for stockroom. We need two students present for each hour that there is a lab occurring in the building. If we increase the number of sections of lab that are offered we will need significant increase in lab hourly student workers.

Student worker to specifically assist with relabeling, lab kit prep, and clean out of storage areas	1	15/hr	Important	GOAL E: Upgrading educational infrastructure	The outdated labels on bottles (~1600) need to be replaced, lab kits for Chem. 100 need to be assembled, and there are various storage areas with old papers and equipment that must be organized. These are all simple, but time-consuming tasks that a dedicated student worker (not necessarily in chemistry even) would be very helpful in completing. Additionally, it is not safe for anyone including our stockroom technician to work in a chemistry lab alone. There should ALWAYS be a second person in the stockroom when any chemicals are be handled or prepared. We are running over 60 hours of labs a week and we need student hourly workers available to support all of these courses in additional hours for students with more training to assist our technician in preparation and switching out the experiments in the labs.

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Important.

Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary
- Conversion (grant to general fund)

Student hourly

Cost estimate:

$15/hour

Occurrence:

- Recurring expense
- One-time augmentation

Recurring

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

General Fund/SEM
Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.
Student hourly workers for stockroom. We need two students present for each hour that there is a lab occurring in the building. If we increase the number of sections of lab that are offered we will need significant increase in lab hourly student workers. Over the past five years, minimum wage has increased by $4/hour or 33%, our weekly hours that we have scheduled laboratories have increased significantly and there has been no recent increase in our student hourly budget. Currently we are not able to schedule one student or supervisor for all hours that labs are running.

The outdated labels on bottles (~1600) need to be replaced, lab kits for 100 need to be assembled, and there are various storage areas with old papers and equipment that must be organized. These are all simple, but time-consuming tasks that a dedicated student worker (not necessarily in chemistry even) would be very helpful in completing. During this current semester we have been limited to 5 student workers in the stockroom. Due to their schedules there have been many times during the week when there is no worker in the stockroom even though there are lab classes occurring. This is unacceptable. We need more student hourly workers to support our rapidly growing lab program. This will only increase if we add a Chemistry Technician Certificate program.
If this position is not filled, what is the potential impact to student success?
We will not be able to continue to increase the number of lab sections.

Professional Development Resource Request(s) : Version by **Moskun, Amy** on **11/14/2022 04:06**

Explain and justify the program's training and professional development needs. Explain how the training/professional development will help the program better meet its goals.
The Chemistry department has been in crisis mode due to the pandemic and staffing shortages. We have identified two areas of need: modern safety training for all faculty and preparation to support the chemical technician certificate program. As we move forward we anticipate the need to attend conferences and ongoing training and departmental workshops to increase student success and promote equity in student learning.
Professional Development Resource Request(s):

- **Professional development for safety training**
- **Professional development and partnerships industry and chemical instrumentation**

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Professional development for safety training	critical
Professional development and partnerships industry and chemical instrumentation	critical

Cost estimate:
$1000/person
Occurrence:

- Recurring expense
- One-time augmentation

One-time for full-time faculty and part-timers.

Recurring for new faculty and student workers
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

SEM

Facilities Resource Request(s) : Version by **Bradbury, Jeffery** on **12/17/2022 01:21**

Identify and justify any facilities and equipment needs. Explain how it will help the program better meet its goals. If possible, indicate other disciplines who may share this space.
The chemistry department's course section offerings have expanded tremendously in the last two years. Much of the expansion was during the pandemic with the addition of remote sections. We do not have the lab space necessary to move all of these sections back onto campus. This is especially the case with Chem. 100 where we went from 8 to 12 sections. We need additional lab space and this space needs to be in close proximity to the stockroom. We need to build an additional lab. **One likely place to add a lab room is over S-124**. Although no other departments will share this space, these courses are needed for a very wide variety of majors and programs across campus. Most of our students in the chemistry department are not majoring in chemistry but chemistry is required for biology, engineering computer science, allied heath, health occupations, nursing and many others. Chem. 110 has increased from 7 to 9 sections.

There needs to be 1) greater clarity about what is covered or not covered in the science building by the facilities budget vs. the SEM budget. 2) greater communication between the facilities department and the chemistry department. We recently were told, by the school plumber, that the facilities budget had been reduced by $4,000,000. As a consequence there would be changes in the things that the facilities budget would cover. Our building's vacuum pump is about to completely fail. The plumber told us that this item is related to teaching and will no longer by covered by the facilities budget. The replacement of the vacuum, which is used for suction during chemical experiments, will need to be paid for by the SEM budget. The cost was $7000.00. In addition to the vacuum pump, our water heaters have not worked since the pandemic.

First of all how do we draw the line between what facilities budget will cover and what the SEM budget will cover? Where is the distinction between something that is strictly "instructional" in nature. For example is the deionized water a teaching related expense? Will fixing the deionized water faucet no longer be covered because it is something specifically related to chemistry instruction? Will the regular tap water faucet be included in the "instructional" column or the facilities column. What about the restroom? How is this school going to pay for the maintenance of our facilities? We are totally unclear as to what is paid for out of what budget. It seems to us that we are being treated as political pawns by someone above us. We need to know how our facilities will be maintained so that our students have access to the quality education in chemistry we are known for.

Secondly, the communication between the chemistry department and facilities needs to be improved. It seems rather odd for the plumber to bring us the news that we have a $7000.00 machine to fix, which we will be needing in the next week, and by the way facilities is not paying for it as they always have. There needs to be better communication. The chemistry faculty have a unique relationship with the building that other departments may not have. Recently, in the middle of lab time, the gas went off. Students were supposed to be using gas burners. There was no communication from anyone that this was going to be an issue and for how long. The faculty had to pursue the issue with the acting dean, and it took several hours to figure this out. All that was needed was a simple email explaining what was happening. Our chemistry department is dependent on the building for our lab programs and our safety. This building must be maintained in a timely manner. There also needs to be a clear channel of communication between the facilities folks and the chemistry department chairs. We have requested a meeting with the facilities director and have not had any acknowledgement of our request.

If the campus moves to a 16-week calendar it will impact the chemistry department significantly. If we go to 16 weeks we will need to increase each lab time by 22 minutes. This is going to put more pressure on our already over-used rooms. The bottom line is the college needs to do a study of the chemistry department lab room use (which does not need to be dumped on

the department chairs!) so that we know if we can run the same number of labs we currently run. This is another reason why we need a new lab.

Our suggestion for the new lab would be to build on top of S-127. Then chemistry would have 5 labs just like biology has 5 lab rooms.

It has recently come to our attention that there have been significant changes in budgeting by facilities. We have been told that our facilities department no longer will pay for any repairs or maintenance for the building or integrated equipment that is "used for instruction". Historically building repairs have been paid by the facilities and maintenance budget. For example, the hot water heater that supplies hot water to all labs in the SEM building has been down for months, if it had been the hot water heater for the restrooms it would be the responsibility of facilities but because the hot water heater is used for instruction facilities will no longer pay for the repair. Additionally this fall, the vacuum pump that provides the plumbed in house vacuum needed repairs and facilities refused to pay for this repair as well. These repairs are both part of integrated equipment within the SEM building not independent specialty equipment added by the chemistry department at a later date. If we are now responsible for building maintenance, we will need a significant budget increase to deal with infrastructure issues. For example, the vacuum pump repair was over $7,000. We cannot keep labs running if we cannot afford consumables due to repairs or not able to afford repairs.
What impact will this have on student success? What is the consequence of not getting this request fulfilled?
Our numbers have increased dramatically, especially in Chem. 100. But Chem 100 has had a significant decrease in the success rate. This is due to the remote nature of instruction. To learn chemistry, a student (especially Chem. 100 students) needs a guided hands-on environment. Chemistry is learned through hands-on experience guided by a good instructor. If the chemistry department does not add lab space then either we will need to cut back on the Chem. 100 sections offered or continue to see the low success rate we have seen in the remote environment.

If there is no increase in budget to cover infrastructure repairs, we will not be able to afford the consumable supplies needed to keep the chemistry labs running. We could also face an emergency with multiple repairs or maintenance needed beyond our budget. This could lead to unsafe conditions in the laboratories, reduced capability to run experiments and reduced quality of student learning and in the long run may require us to decrease our offerings.
Facilities Resource Request(s):
New lab or building.

- **New building/ additional lab space to support growing enrollment and demand.**
- **Large instrument room as we develop Tech certificate and add chemical instrumentation and additional courses**
- **New storage space for increased student lab equipment lockers.**
- **Chemistry lab classes cannot be spread out over different areas of the campus. The lab must be near the stockroom as chemicals cannot be safely and easily transported between two distant locations. It is important that lab classes and the stockroom all be in one building.**
- **Current building must be maintained!**

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Important and critical
Cost estimate:
Millions
Occurrence:

- Recurring expense
- One-time augmentation

A new lab would be a one-time expense. Of course maintenance would be necessary like any other lab.
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value

Technology and Software Resource Request(s) : Version by **Moskun, Amy** on **11/14/2022 04:06**

Identify and justify technology and software needs. Explain how it will help the program better meet its goals. If possible, indicate other disciplines who may share the technology and/or software.

Item	How Many	Approximate Cost (Each)	Importance Level	Strategic Goal	Justification	Impact on Student success	recurring or one time	Total Cost	Total Cost + 20%	Website
iPads/pencils and cart	1	40,000	Important	GOAL A: Strengthen the culture of completion	Chem 100 labs are being converted to a cloud based lab experiment book. As such students will need to collect data during lab using an internet connected readily editable device. This class will need a dedicated set of ipads since it runs just about every hour of the day.	Chem. 100 students will be performing their lab reports on the iPad. This creates a paperless classroom. Without them the students would need to purchase a lab notebook	one time with future replacement	40000	$48,000.00	Apple.com (http://apple.com/)

Replacement iPads Class set 32	2	$40,000	Can Wait	GOAL E: Upgrading educational infrastructure	These iPads will replace our current iPads when they become obsolete	Allows students and instructors to create and visualize molecular models, access chemistry related apps and simulations and create screencasts	one time with future replacement	$80,000	$96,000.00	
Chem Draw Prime (Perpetual License)	4	2260	Important	GOAL E: Upgrading educational infrastructure	ChemDraw Prime is the most efficient chemical drawing editor available to chemists. It will allow us to create chemically accurate, chemical drawings and easily generate standard chemical standard formats, and polish up reactions with the structure clean-up functions.	Allows students and instructors to create and visualize molecular models	recurring	9040	$10,848.00	https://shopinformatics.perkinelmer.com/ChemDraw-Prime-21-F (https://shopinformatics.perkinelmer.com/ChemDraw-Prime-21-
Nananalysis 100MHZ Multinuclear	1	155000	Critical	GOAL E: Upgrading educational infrastructure	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on technique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	155000	$186,000.00	https://www.bruker.com/en/products-and-solutions/mr/nmr/fouri (https://www.bruker.com/en/products-and-solutions/mr/nmr/four
HPLC with Autosampler	2	51000	Critical Instrumentation Class/Important Normal	GOAL B: Ensuring program alignment by strengthening partnerships	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	102000	$122,400.00	

GC-MS with Autosampler	1	88000	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	88000	$105,600.00	https://www.thermofisher.com/order/catalog/product/ISQ7610-A (https://www.thermofisher.com/order/catalog/product/ISQ7610-/
Nicolet IS5 ATR-IR	1	14880	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	14880	$17,856.00	https://www.thermofisher.com/order/catalog/product/IQLAADGA (https://www.thermofisher.com/order/catalog/product/IQLAADG
Atomic Absorption	1	17850	Can Wait	GOAL A: Strengthen the culture of completion	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	17850	$21,420.00	https://www.bucksci.com/products/copy-of-230ats-atomic-absor spectrophotometer (https://www.bucksci.com/products/copy-of-absorption-spectrophotometer)
Ion Chromatography (anion)	1	29200	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ion chromatography is commonly used to analyze environmental samples	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	29200	$35,040.00	https://www.thermofisher.com/order/catalog/product/22176-600 (https://www.thermofisher.com/order/catalog/product/22176-60(

Vernier GC	7	3000	Important	GOAL E: Upgrading educational infrastructure	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	21000	$25,200.00	https://www.vernier.com/product/go-direct-mini-gc/ (https://www.vernier.com/product/go-direct-mini-gc/)
Lab Quest Replacements is this what we want	32	400	Important	GOAL A: Strengthen the culture of completion	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, iPads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	12800	$15,360.00	https://www.vernier.com/product/labquest-3/ (https://www.vernier.com/product/labquest-3/) or https://www.vernier.com/product/labquest-stream/ (https://www.vernier.com/product/labquest-stream/)
Lab Quest charger cables	10	18	Critical	GOAL E: Upgrading educational infrastructure	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	180	$216.00	https://www.vernier.com/product/labquest-charge-station-power (https://www.vernier.com/product/labquest-charge-station-powe
pH probes for Chem 100	34		Can Wait			This allows our students to adequately measure the pH of a solution.	one time with future replacement	0	$0.00	

Color printer for IR	1	600	Important	GOAL E: Upgrading educational infrastructure	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.	This will allow our students to print our their infrared spectra and make correct analysis	one time with future replacement	600	$720.00	https://www.hp.com/us-en/shop/pdp/hp-color-laserjet-pro-m454 (https://www.hp.com/us-en/shop/pdp/hp-color-laserjet-pro-m45
Chemventory Flinn Chemical Inventory System 5-year license	1	350	Important	GOAL F: Enhancing organization effectiveness	This is an online inventory system that keeps track of our Flinn purchases and SDS sheets in one spot.	This software is necessary for the safety of our students and faculty	recurring			https://www.flinnsci.com/products/safety-supplies/chemical-inve supplies/flinns-online-chemventory-inventory-management-syst (https://www.flinnsci.com/products/safety-supplies/chemical-inv supplies/flinns-online-chemventory-inventory-management-syst
Vernier GC	2	3000	Important	GOAL E: Upgrading educational infrastructure	Replacement of 2 currently broken GC's that are shared by 2 students in class/	This allows our students to test the accuracy of their experiments in Organic chemistry.	one time with future replacement	6000	$7,200.00	https://www.vernier.com/product/go-direct-mini-gc (https://www.vernier.com/product/go-direct-mini-gc/)

What impact will this have on student success? What is the consequence of not getting this request fulfilled?

Item	Justification	Impact on Student success
iPads/pencils and cart	Chem 100 labs are being converted to a cloud based lab experiment book. As such students will need to collect data during lab using an internet connected readily editable device. This class will need a dedicated set of iPads since it runs just about every hour of the day.	Chem. 100 students will be performing their lab reports on the iPad. This creates a paperless classroom. Without them the students would need to purchase a lab notebook
Replacement iPads Class set 32	These iPads will replace our current iPads when they become obsolete	Allows students and instructors to create and visualize molecular models, access chemistry related apps and simulations and create screencasts.
Chem Draw Prime (Perpetual License)	ChemDraw Prime is the most efficient chemical drawing editor available to chemists. It will allow us to create chemically accurate, chemical drawings and easily generate standard chemical standard formats, and polish up reactions with the structure clean-up functions.	Allows students and instructors to create and visualize molecular models. Without this students would not have access to the best program for drawing molecular structures
Nananalysis 100MHZ Multinuclear	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on technique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
HPLC with Autosampler	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
GC-MS with Autosampler	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.

Nicolet IS5 ATR-IR	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
Atomic Absorption	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
Ion Chromatography (anion)	Ion chromatography is commonly used to analyze environmental samples	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
Vernier GC	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.
Lab Quest Replacements is this what we want	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, iPads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program. Without this technology our chemistry technician program would be incomplete or jeopardized.
Lab Quest charger cables	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.
pH probes for Chem 100		This allows our students to adequately measure the pH of a solution. Without this technology our students would not be able to measure pH accurately.
Color printer for IR	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.	This will allow our students to print our their infrared spectra and make correct analysis

Technology and Software Resource Request(s):

Item	How Many	Approximate Cost (Each)	Importance Level	Strategic Goal	Justification	Impact on Student success	recurring or one time	Total Cost	Total Cost + 20%	Website
iPads/pencils and cart	1	40,000	Important	GOAL A: Strengthen the culture of completion	Chem 100 labs are being converted to a cloud based lab experiment book. As such students will need to collect data during lab using an internet connected readily editable device. This class will need a dedicated set of iPads since it runs just about every hour of the day.	Chem. 100 students will be performing their lab reports on the iPad. This creates a paperless classroom. Without them the students would need to purchase a lab notebook	one time with future replacement	40000	$48,000.00	Apple.com (http://apple.com/)
Replacement iPads Class set 32	2	$40,000	Can Wait	GOAL E: Upgrading educational infrastructure	These iPads will replace our current iPads when they become obsolete	Allows students and instructors to create and visualize molecular models, access chemistry related apps and simulations and create screencasts	one time with future replacement	$80,000	$96,000.00	

Chem Draw Prime (Perpetual License)	4	2260	Important	GOAL E: Upgrading educational infrastructure	ChemDraw Prime is the most efficient chemical drawing editor available to chemists. It will allow us to create chemically accurate, chemical drawings and easily generate standard chemical standard formats, and polish up reactions with the structure clean-up functions.	Allows students and instructors to create and visualize molecular models	recurring	9040	$10,848.00	https://shopinformatics.perkinelmer.com/ChemDraw-Prime-21-P (https://shopinformatics.perkinelmer.com/ChemDraw-Prime-21-I
Nananalysis 100MHZ Multinuclear	1	155000	Critical	GOAL E: Upgrading educational infrastructure	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on technique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	155000	$186,000.00	https://www.bruker.com/en/products-and-solutions/mr/nmr/fourie (https://www.bruker.com/en/products-and-solutions/mr/nmr/fouri
HPLC with Autosampler	2	51000	Critical Instrumentation Class/Important Normal	GOAL B: Ensuring program alignment by strengthening partnerships	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	102000	$122,400.00	
GC-MS with Autosampler	1	88000	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	88000	$105,600.00	https://www.thermofisher.com/order/catalog/product/ISQ7610-AI (https://www.thermofisher.com/order/catalog/product/ISQ7610-A

Nicolet IS5 ATR-IR	1	14880	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	14880	$17,856.00	https://www.thermofisher.com/order/catalog/product/IQLAADGA (https://www.thermofisher.com/order/catalog/product/IQLAADG/
Atomic Absorption	1	17850	Can Wait	GOAL A: Strengthen the culture of completion	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	17850	$21,420.00	https://www.bucksci.com/products/copy-of-230ats-atomic-absorp spectrophotometer (https://www.bucksci.com/products/copy-of-2 absorption-spectrophotometer)
Ion Chromatography (anion)	1	29200	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ion chromatography is commonly used to analyze environmental samples	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	29200	$35,040.00	https://www.thermofisher.com/order/catalog/product/22176-6000 (https://www.thermofisher.com/order/catalog/product/22176-600
Vernier GC	7	3000	Important	GOAL E: Upgrading educational infrastructure	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	21000	$25,200.00	https://www.vernier.com/product/go-direct-mini-gc/ (https://www.vernier.com/product/go-direct-mini-gc/)

Lab Quest Replacements is this what we want	32	400	Important	GOAL A: Strengthen the culture of completion	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, iPads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	12800	$15,360.00	https://www.vernier.com/product/labquest-3/ (https://www.vernier.com/product/labquest-3/) or https://www.vernier.com/product/labquest-stream/ (https://www.vernier.com/product/labquest-stream/)
Lab Quest charger cables	10	18	Critical	GOAL E: Upgrading educational infrastructure	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.	This will give our students the most up to date learning experience with chemical technology. This would be used in both organic labs and the new chemical technician program.	one time with future replacement	180	$216.00	https://www.vernier.com/product/labquest-charge-station-power- (https://www.vernier.com/product/labquest-charge-station-power
pH probes for Chem 100	34		Can Wait			This allows our students to adequately measure the pH of a solution.	one time with future replacement	0	$0.00	
Color printer for IR	1	600	Important	GOAL E: Upgrading educational infrastructure	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.	This will allow our students to print our their infrared spectra and make correct analysis	one time with future replacement	600	$720.00	https://www.hp.com/us-en/shop/pdp/hp-color-laserjet-pro-m454 (https://www.hp.com/us-en/shop/pdp/hp-color-laserjet-pro-m454

Chemventory Flinn Chemical Inventory System 5-year license	1	350	Important	GOAL F: Enhancing organization effectiveness	This is an online inventory system that keeps track of our Flinn purchases and SDS sheets in one spot.	This software is necessary for the safety of our students and faculty	recurring			https://www.flinnsci.com/products/safety-supplies/chemical-inve supplies/flinns-online-chemventory-inventory-management-syst (https://www.flinnsci.com/products/safety-supplies/chemical-inve supplies/flinns-online-chemventory-inventory-management-syst
Vernier GC	2	3000	Important	GOAL E: Upgrading educational infrastructure	Replacement of 2 currently broken GC's that are shared by 2 students in class/	This allows our students to test the accuracy of their experiments in Organic chemistry.	one time with future replacement	6000	$7,200.00	https://www.vernier.com/product/go-direct-mini-gc (https://www.vernier.com/product/go-direct-mini-gc/)

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Item	Importance Level
iPads/pencils and cart	Important
Replacement iPads Class set 32	Can Wait
Chem Draw Prime (Perpetual License)	Important
Nananalysis 100MHZ Multinuclear	Critical
HPLC with Autosampler	Critical Instrumentation Class/Important Normal
GC-MS with Autosampler	Critical Instrumentation Class/Important Normal
Nicolet IS5 ATR-IR	Critical Instrumentation Class/Important Normal
Atomic Absorption	Can Wait
Ion Chromatography (anion)	Critical Instrumentation Class/Important Normal
Vernier GC	Important
Lab Quest Replacements is this what we want	Important
Lab Quest charger cables	Critical
pH probes for Chem 100	Can Wait
Color printer for IR	Important
Chemventory Flinn Chemical Inventory System 5-year license	Important
Vernier GC	Important

Cost estimate:

Item	How Many	Approximate Cost (Each)	recurring or one time	Total Cost	Total Cost + 20%
iPads/pencils and cart	1	40,000	one time with future replacement	40000	$48,000.00
Replacement iPads Class set 32	2	$40,000	one time with future replacement	$80,000	$96,000.00
Chem Draw Prime (Perpetual License)	4	2260	recurring	9040	$10,848.00
Nananalysis 100MHZ Multinuclear	1	155000	one time with future replacement	155000	$186,000.00
HPLC with Autosampler	2	51000	one time with future replacement	102000	$122,400.00
GC-MS with Autosampler	1	88000	one time with future replacement	88000	$105,600.00
Nicolet IS5 ATR-IR	1	14880	one time with future replacement	14880	$17,856.00
Atomic Absorption	1	17850	one time with future replacement	17850	$21,420.00
Ion Chromatography (anion)	1	29200	one time with future replacement	29200	$35,040.00
Vernier GC	7	3000	one time with future replacement	21000	$25,200.00
Lab Quest Replacements is this what we want	32	400	one time with future replacement	12800	$15,360.00
Lab Quest charger cables	10	18	one time with future replacement	180	$216.00
pH probes for Chem 100	34		one time with future replacement	0	$0.00
Color printer for IR	1	600	one time with future replacement	600	$720.00
Chemventory Flinn Chemical Inventory System 5-year license	1	350	recurring		$2000.00
Vernier GC	2	3000	one time with future replacement	6000	$7,200.00

Occurrence:

- Recurring expense
- One-time augmentation

Item	recurring or one time
iPads/pencils and cart	one time with future replacement
Replacement iPads Class set 32	one time with future replacement
Chem Draw Prime (Perpetual License)	recurring
Nananalysis 100MHZ Multinuclear	one time with future replacement
HPLC with Autosampler	one time with future replacement
GC-MS with Autosampler	one time with future replacement
Nicolet IS5 ATR-IR	one time with future replacement
Atomic Absorption	one time with future replacement
Ion Chromatography (anion)	one time with future replacement
Vernier GC	one time with future replacement
Lab Quest Replacements is this what we want	one time with future replacement
Lab Quest charger cables	one time with future replacement
pH probes for Chem 100	one time with future replacement
Color printer for IR	one time with future replacement
Chemventory Flinn Chemical Inventory System 5-year license	recurring
Vernier GC	one time with future replacement

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage

- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value

Other Resource Request(s) : Version by **Moskun, Amy** on **11/14/2022 04:06**

Identify and justify any other needs. Explain how it will help the program better meet its goals.
We are including the "chemical instrumentation" in both the technology requests section and the other resource requests section. Some may consider a piece of chemical technology such as a mass spectrometer as "technology" and others may consider it "other resource". We are including the chemical technology in both areas of our Program Review Report.

We would like to justify two major types of requests:
1) One of the chemistry department's major goals is to start a chemical technician certificate program. This program will require training on chemical instrumentation.
2) As noted above, our chemistry course enrollment and section offerings have increased significantly over the last four years and during the pandemic. As we move back on to campus this has impacted our consumption of chemicals and glassware and waste disposal. In order to sustain this significant growth we need an increase in our chemistry department operating budget which has not changed in years.
3) Facilities recently notified us, through the plumber, that they are no longer maintaining the facilities that are related to "instruction." For example our vacuum pump needs to be replaced. We cannot run several of our labs without suction. Facilities deems this item as "instructional" even though they are the only ones that have access to it and they are the ones that will facilitate fixing it. They will no longer pay for it. The vacuum pump replacement cost was $7000.00. This now had to come out of the SEM budget. We are unclear now as to what will be paid for by facilities and what will not be paid for by facilities. How do we budget for this? Will facilities continue to pay for our waste disposal? We do not know how much this will cost. Facilities has not given us an amount for chemistry disposal. Nevertheless these expenses must be paid for in order for our department to function. These are critical issues that must be addressed. At this time we have set up a meeting with the interim Vice President to discuss these matters.

Item	How Many	Approximate Cost (Each)	Importance Level	Strategic Goal	Justification	Impact on Student success	One time or recurring	Funding source	Website
Space Requirements									
Nananalysis 100MHZ Multinuclear	1	155000	Critical	GOAL E: Upgrading educational infrastructure	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on techique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.	Allows students access and training on relevant chemical technology			https://w
HPLC with Autosampler	2	51000	Critical Instrumentation Class/Important Normal	GOAL B: Ensuring program alignment by strengthening partnerships	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.	Allows students access and training on relevant chemical technology			

GC-MS with Autosampler	1	88000	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS	Allows students access and training on relevant chemical technology			https://w
Voltmeter	32	75	Important	GOAL E: Upgrading educational infrastructure	We need a class set for a new general chemistry lab	Allows students access and training on relevant chemical technology			https://w
Multi-channel micropipette	16	242.32	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.	Allows students to make accurate chemical measurements			https://w
Single-channel micropipette	32	106	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.	Allows students to make accurate chemical measurements			https://w
Nicolet IS5 ATR-IR	1	14880	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.	Allows students access and training on relevant chemical technology			https://w

Fisher Autotitrators	18	4000	Important	GOAL E: Upgrading educational infrastructure	Autotitrators are often overlooked as a useful piece of equipment in chemistry classes. We push students to perform buret titrations, yet in industry, autotitrators are common place and the glassware is not. Giving students the opportunity to work with such instrumentation will be important for their development. It can also provide rapid results for titrations that are used for characterization of a product in more advanced courses, save time and money on materials.	Allows students access and training on relevant chemical technology			https://w
Hot/Stir Plates	32	550	Important	GOAL E: Upgrading educational infrastructure	We do not currently have enough hot/stir plates to have two class sections using them at the same time. There are two labs that use these, so we need enough for all to be running at the same time.	Allows students to make accurate chemical measurements			https://w
Schlenk Line	10	710	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	Schlenk line is used in organic chemistry labs for manipulating moisture and air-sensitive compounds. This equipment is important as we transition to be more green and attempt to reduce waste generation. Using this equipment is often taught in organic chemistry lab for chem majors.	Allows students to make accurate chemical measurements			https://w
Rotovap (rotary evaporators)	10	7940	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Rotavap is used to quickly remove organic solvents from a reaction vessel. It is safer than using a hot plate to evaporate volatile solvent. This instrument is important as we transition to be more green and attempt to reduce waste generation.	Allows students to make accurate chemical measurements			https://w
Sonicator	2	120	Can Wait	GOAL E: Upgrading educational infrastructure	Sonicator is used to help dissolve hard to dissolve substance in organic chemistry labs. It can also be used to clean glassware.	Allows students to make accurate chemical measurements			https://w
Refrigerator	2	5000	Can Wait	GOAL E: Upgrading educational infrastructure	The refrigerators holding both organic and inorganic chemicals are getting old, and will need to be replaced soon. There are certain spots inside that simply cannot be cleaned anymore.	chemical storage			https://w refrigera
Dishwasher	1	11000	Can Wait	GOAL E: Upgrading educational infrastructure	The dishwasher is aging and will eventually need to be replaced. Currently functioning fine with regular maitenance.	chemical storage and safety			https://w

Combustion Analysis	1		Can Wait	GOAL E: Upgrading educational infrastructure	Combustion analysis is a common analytical technique used to identify unknown samples	Allows students to make accurate chemical measurements			
Atomic Absorption	1	17850	Can Wait	GOAL A: Strengthen the culture of completion	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.	Allows students access and training on relevant chemical technology			https://w
Oven	1	1100	Can Wait	GOAL E: Upgrading educational infrastructure	The oven is very old and will soon need to be replaced. Currently functioning with regular maitenance.	Allows students to make accurate chemical measurements			https://w
Bomb Calorimeter	1	4000	Can Wait	GOAL E: Upgrading educational infrastructure	We need a calorimeter for our second semester general chemistry lab	Allows students to make accurate chemical measurements			https://s gclid=Cj
Ion Chromatography (anion)	1	29200	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ion chromatography is commonly used to analyze environmental samples	Allows students to make accurate chemical measurements			https://w
Microscale Kits for Organic	32	700	Important	GOAL E: Upgrading educational infrastructure	The current number of kits are reaching their limit and need to be updated to match increased enrollment.	Allows students to make accurate chemical measurements			https://w gclid=Cj
Analytical Balance	8	4800	Can Wait	GOAL E: Upgrading educational infrastructure	Some of the current analytical balances are old/damaged beyond repair. These will need to be replaced in the coming years.	Allows students to make accurate chemical measurements			https://w balance
Top Loading Balance	24	2300	Can Wait	GOAL E: Upgrading educational infrastructure	The current balances in the labs (especially 219 and 215) are getting old and will need to be replaced soon.	Allows students to make accurate chemical measurements			https://w balance
Chem 110 glassware set	96	150	Critical	GOAL E: Upgrading educational infrastructure	We do not currently have enough 110 student glassware bins to meet increased enrollment. An added class set will allow the class to run in another lab room as well.	Allows students to make accurate chemical measurements			
Chem 100 Lab Kits	100	150	Critical	GOAL E: Upgrading educational infrastructure	With the growth of this class we have already tun out of equipment boxes, We were able to pull together additional set by taking a few from each of the other classes to make enough of a set for the last class. We cannot grow any more in Chem 100 without added lab equipment,	Allows students to make accurate chemical measurements			

Vernier GC	7	3000	Important	GOAL E: Upgrading educational infrastructure	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.	Allows students access and training on relevant chemical technology			https://w
Lab Quest Replacements is this what we want	32	400	Important	GOAL A: Strengthen the culture of completion	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, Ipads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.	Allows students access and training on relevant chemical technology			https://w
Lab Quest charger cables	10	18	Critical	GOAL E: Upgrading educational infrastructure	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.	Allows students access and training on relevant chemical technology			https://w
pH probes for Chem 100	34		Can Wait			Allows students access and training on relevant chemical technology			
Pipette Pumps	32	100	Can Wait	GOAL E: Upgrading educational infrastructure	The current number of pipette pumps are reaching its limit and needs updating.	Allows students to make accurate chemical measurements			https://w +Perfor 7zB3YD +Perfor 7zB3YD
Ultra Purifier for HPLC	1	6588	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ultrapure water is required to make the mobile phase for a reverse-phase HPLC.	Allows students access and training on relevant chemical technology			https://w
Viscometer	1	10,000	Can Wait	GOAL E: Upgrading educational infrastructure	Viscosity tester for polymers class to test the liquid before extruding etc.	Allows students access and training on relevant chemical technology			https://w d6tmZM 000486
Rheometer	2-3	1300	Can Wait	GOAL E: Upgrading educational infrastructure	This would be for testing for (torsional) strength, great for chem engineers and the polymer chem groups.	Allows students access and training on relevant chemical technology			https://w q=rheor
Water Testing Kits/Instruments	2/year	25	Important	GOAL E: Upgrading educational infrastructure	This is for the take home kits for Chem 101L and possibly for the online version of Chem 100	Allows students access and training on relevant chemical technology			https://w 20&link 841633 Aquariu 20&link 841633

Actual Black Light Boxes	2	364	Important	GOAL E: Upgrading educational infrastructure	The current black light box is made out of cardboard and tape. It's not big enough for students to be able to mark their TLC plates in. Having an actual black light box also will limit UV exposure.	Allows students to make accurate chemical measurements			https://w parmer-
NMR tube cleaner	3	234	Important		The NMR tubes are tiny and breakable. This is the easiest way to safely clean the tubes.	Allows students access and training on relevant chemical technology			https://w
TLC Chambers without the middle lip (not jars)	32	147	Critical	GOAL E: Upgrading educational infrastructure	The current TLC chambers we have are jars that have a lip in the middle of them. They are large, requiring a lot of solvent. Having ACTUAL TLC chambers will have better TLC results, use less materials and prevent errors caused by that middle lip in the chamber.	Allows students to make accurate chemical measurements			https://w
TLC micropipettes	32	34	Critical	GOAL E: Upgrading educational infrastructure	TLC spotters make it easier to keep sample size consistent.	Allows students to make accurate chemical measurements			https://w
Magnetic stir bars	100	5	Important	GOAL E: Upgrading educational infrastructure	We do not currently have enough stir bars to have two class sections using them at the same time. There are three labs that use these, so we need enough for all to be running at the same time.	Allows students to make accurate chemical measurements			https://w fTKKnLi
Plastic totes	36	20	Important	GOAL E: Upgrading educational infrastructure	Used as secondary chemical containers for both transport and storage. Damaged bins need to be replaced.	Allows for safe and successful transport of chemicals			https://w
Dedicated stockroom ipad/tablet/laptop and protective case	1-2	$2,000	Critical	GOAL F: Enhancing organization effectiveness	The stockroom does not currently have a way to access the internet in 218 without using either personal devices or borrowing a student device from the labs. Not all student workers are able to bring personal devices, and the student devices are often in use. A dedicated laptop/tablet would allow more mobility for me and a spot for student workers to access our files.	safety and chemical storage and inventory			
Overhead stirrer for carboy with stand	1	1700	Can Wait	GOAL F: Enhancing organization effectiveness	These allow for safe mixing of large volumes of hazardous chemicals. There is currently one older automatic stirrer for the large carboys. This will need to be replaced in the coming years.	Allows for preparation of chemicals for student use			https://w

Stockroom micropipette set	1	750	Important	GOAL F: Enhancing organization effectiveness	This allows for better measurement and transfer of small volumes of liquids in the stockroom. Currently, the glass pipets available cannot pipet such small volumes.	Allows for preparation of chemicals for student use			https://w
Color printer for IR	1	600	Important	GOAL E: Upgrading educational infrastructure	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.	Allows students access and training on relevant chemical technology			https://w
Consumables and Services									
Increase in instructional budget	1	5000	Important	GOAL E: Upgrading educational infrastructure	Inflation has doubled the cost of many of our most commonly used reagents and equipment. This increase reflects the money needed to cover the added cost of inflation on top of a higher number of lab sections.	Allows for students to continue performing chemical experiments			
Waste Budget (per year)	1	10000-20000	Important	GOAL E: Upgrading educational infrastructure	If facilities will no longer pay for waste, we need money set aside every year to cover this. For specific costs, we should ask for the previous waste info from facilities (ONLY IF THEY ACTUALLY MENTION THIS)	Safety and disposal			
General Maintinence Budget (per year)	1	10000	Important	GOAL E: Upgrading educational infrastructure	Facilities has informed us they will no longer be paying for maintenance on "instructional" equipment (that is, anything that is ONLY used for our classes). This will require a significant increase in our budget to cover the standard maintenance on our fume hoods, vacuum system, industrial water system, etc.	Allows for students to continue performing chemical experiments			

Analytical Balance Calibration -annual	1	3700	Critical	GOAL F: Enhancing organization effectiveness	This is necessary for balance accuracy and longevity. Should be done once a year due to high use of balances.	Allows students to make accurate chemical measurements			https://w
Top loading balance calibration every 2 years	1		Critical	GOAL F: Enhancing organization effectiveness		Allows students to make accurate chemical measurements			
Chemventory Flinn Chemical Inventory System 5-year license	1	350	Important	GOAL F: Enhancing organization effectiveness	This is an online inventory system that keeps track of our Flinn purchases and SDS sheets in one spot.	Chemical inventory and safety and chemical storage			https://w
Carboys for Stockroom (10 & 20L)	10	195	Important	GOAL F: Enhancing organization effectiveness	Many of the carboys are old and no longer seal correctly. These are also useful for dispensing larger volumes of solution in lab setups.	Safe chemical storage, preparation and transport			https://w
Waste containers + funnels	40	200	Critical	GOAL E: Upgrading educational infrastructure	The current waste containers are a hodge-podge of old manufacturer bottles, plastic beakers, and large carboys. A uniform collection system for aqueous waste would reduce confusion, and is more typical of what students will see in other labs. The funnels ensure containers are easy to access without spills/open containers of waste being left out. These waste systems will be kept and reused each year for their specific labs.	Safety and disposal			https://w
Large Periodic Tables	2	220	Critical	GOAL E: Upgrading educational infrastructure	There is one lecture hall with outdated periodic tables due to an initial miscount. Both periodic tables in S202 need to be updated.	Allows students access to most up to date chemical information			https://w
Carrier Gasses for GC			Critical Instrumentation Class/Important Normal	GOAL A: Strengthen the culture of completion		Allows students to make accurate chemical measurements			
Upkeep/Filters Ulta Purifier for HPLC	1	850	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	Required for Ultrapure water system for a reverse phase HPLC	Allows students to make accurate chemical measurements			https://w
NMR tubes	1 (100 pack economy)	135	Important	GOAL A: Strengthen the culture of completion		Allows students access and training on relevant chemical technology			https://w
Deuterated CDCl3	1	$500	Important	GOAL A: Strengthen the culture of completion	Required for NMR experimentation.	Allows students access and training on relevant chemical technology			https://w
Deuterated DMSO	1	534	Important	GOAL A: Strengthen the culture of completion	Required for NMR experimentation.	Allows students access and training on relevant chemical technology			https://w focus=p

O2 for combustion Analysis						Allows students access and training on relevant chemical technology			
TLC plates - Box	2	50	Important	GOAL E: Upgrading educational infrastructure	We are running out of our current TLC Plates, they need to be replaced.	Allows students to make accurate chemical measurements			https://w 4ee5f2e 856312 dcd730
Metal Electrodes	32	30	Important	GOAL E: Upgrading educational infrastructure	We need a class set for a new lab	Allows students to make accurate chemical measurements			https://w 8rHvh7y (https:// 8rHvh7y
Set of lab coats or scrubs for safety showers	10	20	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them something to wear home so they don't have to put wet and contaminated clothing back on. Placing one set (a medium and a 5 XL) will cover most students needs.	Student safety			https://w Drawstr
Set Cheap shoes for safety showers	15	10	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them shoes to wear home so they don't have to put wet and contaminated shoes back on. Placing one set (a small, large and a 5 XL) will cover most students needs.	Student safety			https://w Black-1
Set Cheap shower curtains safety showers	5	5	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way provide privacy to the student while the instructor holds up the shower curtain. Also, the curtain will limit splashing and further contamination of an area after a spill..	Student safety			https://w (https://
Towels for safety showers	5	15	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way for the student to dry off.	Student safety			
Chem 101 Take home kits	32	50	Critical	GOAL F: Enhancing organization effectiveness	This will allow students to do labs at home without having to purchase nonperishable materials.	Allows for preparation of chemicals for student use			
Pipette tips (1000 micropipette tips per bag)	10	54.03	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Required consumable for the micropipettes	Allows for preparation of chemicals for student use			https://w
Calibration for micropipettes (every 2-4 years)	50	30	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Required maintenance for the micropipettes	Allows for preparation of chemicals for student use			

Plastic chemical trays	20	30	Critical	GOAL E: Upgrading educational infrastructure	This is to allow us to set up stations that students can move to various area of the classroom to do different experiments in a rotation, saving them class time from waiting for equipment, and saving us from needing extra equipment and chemicals.	Allows for preparation of chemicals for student use			https://w
Chem 101 lab kits	60	100	Critical	GOAL A: Strengthen the culture of completion	This will allow students to do labs at home without having to purchase nonperishable materials.	Allows for preparation of chemicals for student use			
pH pens	40	90	Important	GOAL E: Upgrading educational infrastructure	This will allow students to better understand pH and serial dilution, which is necessary for their further studies.	Allows students access and training on relevant chemical technology			https://w
new/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	1	6800	Can Wait	GOAL E: Upgrading educational infrastructure	This is a replacement diamond for when the current one is damaged. The warranty on the current one ends this year.	Allows students access and training on relevant chemical technology			https://w analysis
IR Warranty (annual)	7	3295	Important	GOAL E: Upgrading educational infrastructure	for one preventative maintenance (PM) and unlimited emergency repairs (our machine was purchased in 2014 for $24K); includes the diamond	Allows students access and training on relevant chemical technology			https://w analysis
Vernier GC	2	3000	Important	GOAL E: Upgrading educational infrastructure	Replacement of 2 currently broken GCs that are shared by 2 students in class/	Allows students access and training on relevant chemical technology			https://w
Vernier GC Syringe	8	90	Important	GOAL E: Upgrading educational infrastructure	This is a replacement set of syringes. these needles are damaged when bent and have been in use for 7 years, they should be replaced as they break.	Allows students access and training on relevant chemical technology			https://w
Chemventory (Please check with Rachel)	7	100	Important	GOAL F: Enhancing organization effectiveness	This tracks the chemistry inventory and provides associated GHS forms for most chemicals in our classes. It is an annual contract, but has a multi year discount.	Chemical inventory, storage and student safety			https://w
Replacement sink strainers	32	150	Can Wait	GOAL E: Upgrading educational infrastructure	These rust over time and need regular replacement to keep the bench top sinks from getting damaged or clogged. (This might go through facilities but has been challenging to get previously.)	Chemical storage and student safety			

What impact will this have on student success? What is the consequence of not getting this request fulfilled?

Item	Justification and impact on student success
Nananalysis 100MHZ Multinuclear	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on technique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.

HPLC with Autosampler	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.
GC-MS with Autosampler	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS
Voltmeter	We need a class set for a new general chemistry lab
Multi-channel micropipette	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.
Single-channel micropipette	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.
Nicolet IS5 ATR-IR	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.
Fisher Autotitrators	Autotitrators are often overlooked as a useful piece of equipment in chemistry classes. We push students to perform buret titrations, yet in industry, autotitrators are common place and the glassware is not. Giving students the opportunity to work with such instrumentation will be important for their development. It can also provide rapid results for titrations that are used for characterization of a product in more advanced courses, save time and money on materials.
Hot/Stir Plates	We do not currently have enough hot/stir plates to have two class sections using them at the same time. There are two labs that use these, so we need enough for all to be running at the same time.
Schlenk Line	Schlenk line is used in organic chemistry labs for manipulating moisture and air-sensitive compounds. This equipment is important as we transition to be more green and attempt to reduce waste generation. Using this equipment is often taught in organic chemistry lab for chem majors.
Rotovap (rotary evaporators)	Rotavap is used to quickly remove organic solvents from a reaction vessel. It is safer than using a hot plate to evaporate volatile solvent. This instrument is important as we transition to be more green and attempt to reduce waste generation.
Sonicator	Sonicator is used to help dissolve hard to dissolve substance in organic chemistry labs. It can also be used to clean glassware.
Refrigerator	The refrigerators holding both organic and inorganic chemicals are getting old, and will need to be replaced soon. There are certain spots inside that simply cannot be cleaned anymore.
Dishwasher	The dishwasher is aging and will eventually need to be replaced. Currently functioning fine with regular maintenance.
Combustion Analysis	Combustion analysis is a common analytical technique used to identify unknown samples
Atomic Absorption	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.
Oven	The oven is very old and will soon need to be replaced. Currently functioning with regular maintenance.
Bomb Calorimeter	We need a calorimeter for our second semester general chemistry lab
Ion Chromatography (anion)	Ion chromatography is commonly used to analyze environmental samples
Microscale Kits for Organic	The current number of kits are reaching their limit and need to be updated to match increased enrollment.
Analytical Balance	Some of the current analytical balances are old/damaged beyond repair. These will need to be replaced in the coming years.
Top Loading Balance	The current balances in the labs (especially 219 and 215) are getting old and will need to be replaced soon.
Chem 110 glassware set	We do not currently have enough 110 student glassware bins to meet increased enrollment. An added class set will allow the class to run in another lab room as well.
Chem 100 Lab Kits	With the growth of this class we have already tun out of equipment boxes, We were able to pull together additional set by taking a few from each of the other classes to make enough of a set for the last class. We cannot grow any more in Chem 100 without added lab equipment,
Vernier GC	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.
Lab Quest Replacements is this what we want	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, iPads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.
Lab Quest charger cables	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.
pH probes for Chem 100	
Pipette Pumps	The current number of pipette pumps are reaching its limit and needs updating.
Ultra Purifier for HPLC	Ultrapure water is required to make the mobile phase for a reverse-phase HPLC.
Viscometer	Viscosity tester for polymers class to test the liquid before extruding etc.
Rheometer	This would be for testing for (torsional) strength, great for chem engineers and the polymer chem groups.
Water Testing Kits/Instruments	This is for the take home kits for Chem 101L and possibly for the online version of Chem 100
Actual Black Light Boxes	The current black light box is made out of cardboard and tape. It's not big enough for students to be able to mark their TLC plates in. Having an actual black light box also will limit UV exposure.
NMR tube cleaner	The NMR tubes are tiny and breakable. This is the easiest way to safely clean the tubes.
TLC Chambers without the middle lip (not jars)	The current TLC chambers we have are jars that have a lip in the middle of them. They are large, requiring a lot of solvent. Having ACTUAL TLC chambers will have better TLC results, use less materials and prevent errors caused by that middle lip in the chamber.
TLC micropipettes	TLC spotters make it easier to keep sample size consistent.
magnetic stir bars	We do not currently have enough stir bars to have two class sections using them at the same time. There are three labs that use these, so we need enough for all to be running at the same time.

Plastic totes	Used as secondary chemical containers for both transport and storage. Damaged bins need to be replaced.
dedicated stockroom ipad/tablet/laptop and protective case	The stockroom does not currently have a way to access the internet in 218 without using either personal devices or borrowing a student device from the labs. Not all student workers are able to bring personal devices, and the student devices are often in use. A dedicated laptop/tablet would allow more mobility for me and a spot for student workers to access our files.
Overhead stirrer for carboy with stand	These allow for safe mixing of large volumes of hazardous chemicals. There is currently one older automatic stirrer for the large carboys. This will need to be replaced in the coming years.
Stockroom micropipette set	This allows for better measurement and transfer of small volumes of liquids in the stockroom. Currently, the glass pipets available cannot pipet such small volumes.
Color printer for IR	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.
Increase in instructional budget	Inflation has doubled the cost of many of our most commonly used reagents and equipment. This increase reflects the money needed to cover the added cost of inflation on top of a higher number of lab sections.
Waste Budget (per year)	If facilities will no longer pay for waste, we need money set aside every year to cover this. For specific costs, we should ask for the previous waste info from facilities . We re unclear as to the cost of waste and who is going to pay for it going forward. This value is a guess
General maintenance Budget (per year)	Facilities has informed us they will no longer be paying for maintenance on "instructional" equipment (that is, anything that is ONLY used for our classes). This will require a significant increase in our budget to cover the standard maintenance on our fume hoods, vacuum system, industrial water system, etc.
Analytical Balance Calibration -annual	This is necessary for balance accuracy and longevity. Should be done once a year due to high use of balances.
Top loading balance calibration every 2 years	
Chemventory Flinn Chemical Inventory System 5-year license	This is an online inventory system that keeps track of our Flinn purchases and SDS sheets in one spot.
Carboys for Stockroom (10 & 20L)	Many of the carboys are old and no longer seal correctly. These are also useful for dispensing larger volumes of solution in lab setups.
Waste containers + funnels	The current waste containers are a hodge-podge of old manufacturer bottles, plastic beakers, and large carboys. A uniform collection system for aqueous waste would reduce confusion, and is more typical of what students will see in other labs. The funnels ensure containers are easy to access without spills/open containers of waste being left out. These waste systems will be kept and reused each year for their specific labs.
Large Periodic Tables	There is one lecture hall with outdated periodic tables due to an initial miscount. Both periodic tables in S202 need to be updated.
Carrier Gasses for GC	
Upkeep/Filters Ultra Purifier for HPLC	Required for Ultrapure water system for a reverse phase HPLC
NMR tubes	
deuterated CDCl3	Required for NMR experimentation.
deuterated DMSO	Required for NMR experimentation.
O2 for combustion Analysis	
TLC plates - Box	We are running out of our current TLC Plates, they need to be replaced.
Metal Electrodes	We need a class set for a new lab
Set of lab coats or scrubs for safety showers	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them something to wear home so they don't have to put wet and contaminated clothing back on. Placing one set (a medium and a 5 XL) will cover most students needs.
Set Cheap shoes for safety showers	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them shoes to wear home so they don't have to put wet and contaminated shoes back on. Placing one set (a small, large and a 5 XL) will cover most students needs.
Set Cheap shower curtains safety showers	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way provide privacy to the student while the instructor holds up the shower curtain. Also, the curtain will limit splashing and further contamination of an area after a spill..
Towels for safety showers	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way for the student to dry off.
Chem 101 Take home kits	This will allow students to do labs at home without having to purchase nonperishable materials.
Pipette tips (1000 micropipette tips per bag)	Required consumable for the micropipettes
Calibration for micropipettes (every 2-4 years)	Required maintenance for the micropipettes
Plastic chemical trays	This is to allow us to set up stations that students can move to various areas of the classroom to do different experiments in a rotation, saving them class time from waiting for equipment, and saving us from needing extra equipment and chemicals.
Chem 101 lab kits	This will allow students to do labs at home without having to purchase nonperishable materials.
pH pens	This will allow students to better understand pH and serial dilution, which is necessary for their further studies.
new/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	This is a replacement diamond for when the current one is damaged. The warranty on the current one ends this year.
IR Warranty (annual)	for one preventative maintenance (PM) and unlimited emergency repairs (our machine was purchased in 2014 for $24K); includes the diamond
Vernier GC	Replacement of 2 currently broken GC's that are shared by 2 students in class/
Vernier GC Syringe	This is a replacement set of syringes. these needles are damaged when bent and have been in use for 7 years, they should be replaced as they break.
Chemical Respirator	Chemical respirator in each lab that would allow for presence in lab in the case of a chemical spill or earthquake.
Replacement sink strainers	These rust over time and need regular replacement to keep the bench top sinks from getting damaged or clogged. (This might go through facilities but has been challenging to get previously.)

Other Resource Request(s):

Item	Impact on Student success		How Many	Approximate Cost (Each)	Importance Level	Strategic Goal	Justification	Impact on Student success	To
Nananalysis 100MHZ Multinuclear	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	1	155000	Critical	GOAL E: Upgrading educational infrastructure	NMR is a ubiquitous technique across organic chemistry and instrumental work. It is one of the few ways we can at our level express atomic/molecular scale up to macroscale with relative reliability. Currently, we simply do hand out interpretation. There is no hands-on technique and the answers can be looked up. With an NMR, we can add useful experiences to synthesis work and give future researchers a leg up on techniques used in research laboratories.	Allows students access and training on relevant chemical technology	15
HPLC with Autosampler	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	2	51000	Critical Instrumentation Class/Important Normal	GOAL B: Ensuring program alignment by strengthening partnerships	HPLC is a technique often used in industry/research, but rarely in the teaching classroom. It would be critical to have in an instrumentation class, but can add valuable skills and experiments to the organic chemistry side as well. Separations in real labs often do not use a column and packing material, they use HPLC.	Allows students access and training on relevant chemical technology	10
GC-MS with Autosampler	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	1	88000	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool couples two very important techniques used in chemistry and the instrumental/laboratory technician world -- gas chromatography and mass spectroscopy. The addition of an auto sampler allows for high throughput and would allow for future lab technicians/industry workers to use tools that are actually used in their field. CRITICAL FOR INSTRUMENTAL CLASS/IMPORTANT FOR NORMAL CLASS	Allows students access and training on relevant chemical technology	88

Voltmeter	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	32	75	Important	GOAL E: Upgrading educational infrastructure	We need a class set for a new general chemistry lab	Allows students access and training on relevant chemical technology	24
Multi-channel micropipette	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	Recurring	16	242.32	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.	Allows students to make accurate chemical measurements	38
Single-channel micropipette	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	32	106	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	This tool is important in doing any type of experiment involving plate readers. It is easy to use but hard to master and be efficient. Hand on experience is a must. It is also great for serial dilution experiments.	Allows students to make accurate chemical measurements	33
Nicolet IS5 ATR-IR	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	1	14880	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	The current infrared spectrometer is a bottleneck in the classroom. With only one instrument, students can develop a backlog of samples to run. In addition, if the instrument goes down for any reason, we are left without an important component in the organic lab. When the department begins to develop a quantitative class/instrumentation class, this will be even more important as more students will be using the equipment.	Allows students access and training on relevant chemical technology	14

Fisher Autotitrators	without this instrument students will not have access to the most up to date chemical technology. We will not be able to develop our chemical technician certificate program	One Time augmentation with maintenance and replacement at end of cycle	18	4000	Important	GOAL E: Upgrading educational infrastructure	Autotitrators are often overlooked as a useful piece of equipment in chemistry classes. We push students to perform buret titrations, yet in industry, autotitrators are common place and the glassware is not. Giving students the opportunity to work with such instrumentation will be important for their development. It can also provide rapid results for titrations that are used for characterization of a product in more advanced courses, save time and money on materials.	Allows students access and training on relevant chemical technology	72
Hot/Stir Plates	we will not be able to run our labs without hotplates	One Time augmentation with maintenance and replacement at end of cycle	32	550	Important	GOAL E: Upgrading educational infrastructure	We do not currently have enough hot/stir plates to have two class sections using them at the same time. There are two labs that use these, so we need enough for all to be running at the same time.	Allows students to make accurate chemical measurements	17
Schlenk Line		One Time augmentation with maintenance and replacement at end of cycle	10	710	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	Schlenk line is used in organic chemistry labs for manipulating moisture and air-sensitive compounds. This equipment is important as we transition to be more green and attempt to reduce waste generation. Using this equipment is often taught in organic chemistry lab for chem majors.	Allows students to make accurate chemical measurements	71
Rotovap (rotary evaporators)		One Time augmentation with maintenance and replacement at end of cycle	10	7940	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Rotavap is used to quickly remove organic solvents from a reaction vessel. It is safer than using a hot plate to evaporate volatile solvent. This instrument is important as we transition to be more green and attempt to reduce waste generation.	Allows students to make accurate chemical measurements	79
Sonicator		One Time augmentation with maintenance and replacement at end of cycle	2	120	Can Wait	GOAL E: Upgrading educational infrastructure	Sonicator is used to help dissolve hard to dissolve substance in organic chemistry labs. It can also be used to clean glassware.	Allows students to make accurate chemical measurements	24
Refrigerator		One Time augmentation with maintenance and replacement at end of cycle	2	5000	Can Wait	GOAL E: Upgrading educational infrastructure	The refrigerators holding both organic and inorganic chemicals are getting old, and will need to be replaced soon. There are certain spots inside that simply cannot be cleaned anymore.	chemical storage	10

Dishwasher		One Time augmentation with maintenance and replacement at end of cycle	1	11000	Can Wait	GOAL E: Upgrading educational infrastructure	The dishwasher is aging and will eventually need to be replaced. Currently functioning fine with regular maintenance.	chemical storage and safety	11
Combustion Analysis		One Time augmentation with maintenance and replacement at end of cycle	1		Can Wait	GOAL E: Upgrading educational infrastructure	Combustion analysis is a common analytical technique used to identify unknown samples	Allows students to make accurate chemical measurements	0
Atomic Absorption		One Time augmentation with maintenance and replacement at end of cycle	1	17850	Can Wait	GOAL A: Strengthen the culture of completion	Atomic absorption is an excellent tool to add to a quantitative analysis class. There may be uses in general chemistry as well as this is useful for determination of concentration similar to Beer's Law, but also in terms of identification of elements.	Allows students access and training on relevant chemical technology	17
Oven		One Time augmentation with maintenance and replacement at end of cycle	1	1100	Can Wait	GOAL E: Upgrading educational infrastructure	The oven is very old and will soon need to be replaced. Currently functioning with regular maintenance.	Allows students to make accurate chemical measurements	11
Bomb Calorimeter		One Time augmentation with maintenance and replacement at end of cycle	1	4000	Can Wait	GOAL E: Upgrading educational infrastructure	We need a calorimeter for our second semester general chemistry lab	Allows students to make accurate chemical measurements	40
Ion Chromatography (anion)		One Time augmentation with maintenance and replacement at end of cycle	1	29200	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ion chromatography is commonly used to analyze environmental samples	Allows students to make accurate chemical measurements	29
Microscale Kits for Organic		One Time augmentation with maintenance and replacement at end of cycle	32	700	Important	GOAL E: Upgrading educational infrastructure	The current number of kits are reaching their limit and need to be updated to match increased enrollment.	Allows students to make accurate chemical measurements	22
Analytical Balance		One Time augmentation with maintenance and replacement at end of cycle	8	4800	Can Wait	GOAL E: Upgrading educational infrastructure	Some of the current analytical balances are old/damaged beyond repair. These will need to be replaced in the coming years.	Allows students to make accurate chemical measurements	38
Top Loading Balance			24	2300	Can Wait	GOAL E: Upgrading educational infrastructure	The current balances in the labs (especially 219 and 215) are getting old and will need to be replaced soon.	Allows students to make accurate chemical measurements	55

Chem 110 glassware set		One Time augmentation with maintenance and replacement at end of cycle	96	150	Critical	GOAL E: Upgrading educational infrastructure	We do not currently have enough 110 student glassware bins to meet increased enrollment. An added class set will allow the class to run in another lab room as well.	Allows students to make accurate chemical measurements	14
Chem 100 Lab Kits		One Time augmentation with maintenance and replacement at end of cycle	100	150	Critical	GOAL E: Upgrading educational infrastructure	With the growth of this class we have already tun out of equipment boxes, We were able to pull together additional set by taking a few from each of the other classes to make enough of a set for the last class. We cannot grow any more in Chem 100 without added lab equipment,	Allows students to make accurate chemical measurements	15
Vernier GC		One Time augmentation with maintenance and replacement at end of cycle	7	3000	Important	GOAL E: Upgrading educational infrastructure	The current number of GC's we have can limit students abilities to use them. It's important for students to have time to use an instrument, learn how to do proper injections and obtain usable data. With more GC's we can ensure that students have this experience.	Allows students access and training on relevant chemical technology	21
Lab Quest Replacements is this what we want		One Time augmentation with maintenance and replacement at end of cycle	32	400	Important	GOAL A: Strengthen the culture of completion	Many times students do not have their phone or their phone is not charged. Many of the instruments we have require a bluetooth connection. The current iteration of Lab Quests do not have that great of a bluetooth connection. Having Labquests available instead of having students need to use their phones, iPads, or laptops makes the lab run faster and doesn't rely on the student to provide a material.	Allows students access and training on relevant chemical technology	12
Lab Quest charger cables		One Time augmentation with maintenance and replacement at end of cycle	10	18	Critical	GOAL E: Upgrading educational infrastructure	We currently do not have enough cables to match the number of charging stations, severely limiting the number of devices we can charge at once.	Allows students access and training on relevant chemical technology	18
pH probes for Chem 100		One Time augmentation with maintenance and replacement at end of cycle	34		Can Wait			Allows students access and training on relevant chemical technology	0
Pipette Pumps		One Time augmentation with maintenance and replacement at end of cycle	32	100	Can Wait	GOAL E: Upgrading educational infrastructure	The current number of pipette pumps are reaching its limit and needs updating.	Allows students to make accurate chemical measurements	32

Ultra Purifier for HPLC		One Time augmentation with maintenance and replacement at end of cycle	1	6588	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Ultra pure water is required to make the mobile phase for a reverse-phase HPLC.	Allows students access and training on relevant chemical technology	65
Viscometer		One Time augmentation with maintenance and replacement at end of cycle	1	10,000	Can Wait	GOAL E: Upgrading educational infrastructure	Viscosity tester for polymers class to test the liquid before extruding etc.	Allows students access and training on relevant chemical technology	10
Rheometer		One Time augmentation with maintenance and replacement at end of cycle	2-3	1300	Can Wait	GOAL E: Upgrading educational infrastructure	This would be for testing for (torsional) strength, great for chem engineers and the polymer chem groups.	Allows students access and training on relevant chemical technology	57
Water Testing Kits/Instruments		Recurring	2/year	25	Important	GOAL E: Upgrading educational infrastructure	This is for the take home kits for Chem 101L and possibly for the online version of Chem 100	Allows students access and training on relevant chemical technology	#v
Actual Black Light Boxes		One Time augmentation with maintenance and replacement at end of cycle	2	364	Important	GOAL E: Upgrading educational infrastructure	The current black light box is made out of cardboard and tape. It's not big enough for students to be able to mark their TLC plates in. Having an actual black light box also will limit UV exposure.	Allows students to make accurate chemical measurements	72
NMR tube cleaner		One Time augmentation with maintenance and replacement at end of cycle	3	234	Important		The NMR tubes are tiny and breakable. This is the easiest way to safely clean the tubes.	Allows students access and training on relevant chemical technology	70
TLC Chambers without the middle lip (not jars)		One Time augmentation with maintenance and replacement at end of cycle	32	147	Critical	GOAL E: Upgrading educational infrastructure	The current TLC chambers we have are jars that have a lip in the middle of them. They are large, requiring a lot of solvent. Having ACTUAL TLC chambers will have better TLC results, use less materials and prevent errors caused by that middle lip in the chamber.	Allows students to make accurate chemical measurements	47
TLC micropipettes		Recurring	32	34	Critical	GOAL E: Upgrading educational infrastructure	TLC spotters make it easier to keep sample size consistent.	Allows students to make accurate chemical measurements	10
Magnetic stir bars		One Time augmentation with maintenance and replacement at end of cycle	100	5	Important	GOAL E: Upgrading educational infrastructure	We do not currently have enough stir bars to have two class sections using them at the same time. There are three labs that use these, so we need enough for all to be running at the same time.	Allows students to make accurate chemical measurements	50
Plastic totes		One Time augmentation with maintenance and replacement at end of cycle	36	20	Important	GOAL E: Upgrading educational infrastructure	Used as secondary chemical containers for both transport and storage. Damaged bins need to be replaced.	Allows for safe and successful transport of chemicals	72

Dedicated stockroom ipad/tablet/laptop and protective case		One Time augmentation with maintenance and replacement at end of cycle	1-2	$2,000	Critical	GOAL F: Enhancing organization effectiveness	The stockroom does not currently have a way to access the internet in 218 without using either personal devices or borrowing a student device from the labs. Not all student workers are able to bring personal devices, and the student devices are often in use. A dedicated laptop/tablet would allow more mobility for me and a spot for student workers to access our files.	safety and chemical storage and inventory	89
Overhead stirrer for carboy with stand		One Time augmentation with maintenance and replacement at end of cycle	1	1700	Can Wait	GOAL F: Enhancing organization effectiveness	These allow for safe mixing of large volumes of hazardous chemicals. There is currently one older automatic stirrer for the large carboys. This will need to be replaced in the coming years.	Allows for preparation of chemicals for student use	17
Stockroom micropipette set		One Time augmentation with maintenance and replacement at end of cycle	1	750	Important	GOAL F: Enhancing organization effectiveness	This allows for better measurement and transfer of small volumes of liquids in the stockroom. Currently, the glass pipets available cannot pipet such small volumes.	Allows for preparation of chemicals for student use	75
Color printer for IR		One Time augmentation with maintenance and replacement at end of cycle	1	600	Important	GOAL E: Upgrading educational infrastructure	The color printer is specifically for experiments that have timed reactions, where the progress is recorded via the IR. The color printer allows the different times on the same graph, and a color copy is required for the lab notebook. Since many students do not have access to a color printer at home, they use the IR printer as their only copy. The current printer (the broken one) was purchased in 2014 along with the IR machine, and we were told by IT that it is overdue – usually the printer would have been replaced sooner than now (8 years later), they said. There is currently a black and white printer connected to the IR, which functional but not ideal.	Allows students access and training on relevant chemical technology	60
									0
Increase in instructional budget		Recurring	1	5000	Important	GOAL E: Upgrading educational infrastructure	Inflation has doubled the cost of many of our most commonly used reagents and equipment. This increase reflects the money needed to cover the added cost of inflation on top of a higher number of lab sections.	Allows for students to continue performing chemical experiments	50

Waste Budget (per year)		Recurring	1	10000-20000	Important	GOAL E: Upgrading educational infrastructure	If facilities will no longer pay for waste, we need money set aside every year to cover this. For specific costs, we should ask for the previous waste info from facilities . We re unclear as to the cost of waste and who is going to pay for it going forward. This value is a guess	Safety and disposal	#v
General Maintenance Budget (per year)		Recurring	1	10000	Important	GOAL E: Upgrading educational infrastructure	Facilities has informed us they will no longer be paying for maintenance on "instructional" equipment (that is, anything that is ONLY used for our classes). This will require a significant increase in our budget to cover the standard maintenance on our fume hoods, vacuum system, industrial water system, etc.	Allows for students to continue performing chemical experiments	10
Analytical Balance Calibration -annual		One Time augmentation with maintenance and replacement at end of cycle	1	3700	Critical	GOAL F: Enhancing organization effectiveness	This is necessary for balance accuracy and longevity. Should be done once a year due to high use of balances.	Allows students to make accurate chemical measurements	37
Top loading balance calibration every 2 years		One Time augmentation with maintenance and replacement at end of cycle	1		Critical	GOAL F: Enhancing organization effectiveness		Allows students to make accurate chemical measurements	0
Chemventory Flinn Chemical Inventory System 5-year license		Recurring	1	350	Important	GOAL F: Enhancing organization effectiveness	This is an online inventory system that keeps track of our Flinn purchases and SDS sheets in one spot.	Chemical inventory and safety and chemical storage	
Carboys for Stockroom (10 & 20L)		One Time augmentation with maintenance and replacement at end of cycle	10	195	Important	GOAL F: Enhancing organization effectiveness	Many of the carboys are old and no longer seal correctly. These are also useful for dispensing larger volumes of solution in lab setups.	Safe chemical storage, preparation and transport	19
Waste containers + funnels		One Time augmentation with maintenance and replacement at end of cycle	40	200	Critical	GOAL E: Upgrading educational infrastructure	The current waste containers are a hodge-podge of old manufacturer bottles, plastic beakers, and large carboys. A uniform collection system for aqueous waste would reduce confusion, and is more typical of what students will see in other labs. The funnels ensure containers are easy to access without spills/open containers of waste being left out. These waste systems will be kept and reused each year for their specific labs.	Safety and disposal	80

Large Periodic Tables		One Time augmentation with maintenance and replacement at end of cycle	2	220	Critical	GOAL E: Upgrading educational infrastructure	There is one lecture hall with outdated periodic tables due to an initial miscount. Both periodic tables in S202 need to be updated.	Allows students access to most up to date chemical information	44
Carrier Gasses for GC		One Time augmentation with maintenance and replacement at end of cycle			Critical Instrumentation Class/Important Normal	GOAL A: Strengthen the culture of completion		Allows students to make accurate chemical measurements	0
Upkeep/Filters Ultra Purifier for HPLC		One Time augmentation with maintenance and replacement at end of cycle	1	850	Important Instrumentation Class/Can Wait Normal	GOAL E: Upgrading educational infrastructure	Required for Ultra pure water system for a reverse phase HPLC	Allows students to make accurate chemical measurements	85
NMR tubes		One Time augmentation with maintenance and replacement at end of cycle	1 (100 pack economy)	135	Important	GOAL A: Strengthen the culture of completion		Allows students access and training on relevant chemical technology	#v
Deuterated CDCl3		One Time augmentation with maintenance and replacement at end of cycle	1	$500	Important	GOAL A: Strengthen the culture of completion	Required for NMR experimentation.	Allows students access and training on relevant chemical technology	$5
Deuterated DMSO		Recurring	1	534	Important	GOAL A: Strengthen the culture of completion	Required for NMR experimentation.	Allows students access and training on relevant chemical technology	53
O2 for combustion Analysis		Recurring						Allows students access and training on relevant chemical technology	0
TLC plates - Box		Recurring	2	50	Important	GOAL E: Upgrading educational infrastructure	We are running out of our current TLC Plates, they need to be replaced.	Allows students to make accurate chemical measurements	10
Metal Electrodes		One Time augmentation with maintenance and replacement at end of cycle	32	30	Important	GOAL E: Upgrading educational infrastructure	We need a class set for a new lab	Allows students to make accurate chemical measurements	96
Set of lab coats or scrubs for safety showers		Recurring	10	20	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them something to wear home so they don't have to put wet and contaminated clothing back on. Placing one set (a medium and a 5 XL) will cover most students needs.	Student safety	20

Set Cheap shoes for safety showers		Recurring	15	10	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must strip down to use the shower correctly, this will provide them shoes to wear home so they don't have to put wet and contaminated shoes back on. Placing one set (a small, large and a 5 XL) will cover most students needs.	Student safety	15
Set Cheap shower curtains safety showers		One Time augmentation with maintenance and replacement at end of cycle	5	5	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way provide privacy to the student while the instructor holds up the shower curtain. Also, the curtain will limit splashing and further contamination of an area after a spill..	Student safety	25
Towels for safety showers		One Time augmentation with maintenance and replacement at end of cycle	5	15	Critical	GOAL F: Enhancing organization effectiveness	This is a Privacy / safety issue. If a student must use the shower, this will provide an easy way for the student to dry off.	Student safety	75
Chem 101 Take home kits		Recurring	32	50	Critical	GOAL F: Enhancing organization effectiveness	This will allow students to do labs at home without having to purchase nonperishable materials.	Allows for preparation of chemicals for student use	16
Pipette tips (1000 micropipette tips per bag)		One Time augmentation with maintenance and replacement at end of cycle	10	54.03	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Required consumable for the micropipettes	Allows for preparation of chemicals for student use	54
Calibration for micropipettes (every 2-4 years)		One Time augmentation with maintenance and replacement at end of cycle	50	30	Critical Instrumentation Class/Important Normal	GOAL E: Upgrading educational infrastructure	Required maintenance for the micropipettes	Allows for preparation of chemicals for student use	15
Plastic chemical trays		One Time augmentation with maintenance and replacement at end of cycle	20	30	Critical	GOAL E: Upgrading educational infrastructure	This is to allow us to set up stations that students can move to various areas of the classroom to do different experiments in a rotation, saving them class time from waiting for equipment, and saving us from needing extra equipment and chemicals.	Allows for preparation of chemicals for student use	60
Chem 101 lab kits		Recurring	60	100	Critical	GOAL A: Strengthen the culture of completion	This will allow students to do labs at home without having to purchase nonperishable materials.	Allows for preparation of chemicals for student use	60
pH pens		One Time augmentation with maintenance and replacement at end of cycle	40	90	Important	GOAL E: Upgrading educational infrastructure	This will allow students to better understand pH and serial dilution, which is necessary for their further studies.	Allows students access and training on relevant chemical technology	36

new/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)		One Time augmentation with maintenance and replacement at end of cycle	1	6800	Can Wait	GOAL E: Upgrading educational infrastructure	This is a replacement diamond for when the current one is damaged. The warranty on the current one ends this year.	Allows students access and training on relevant chemical technology	68
IR Warranty (annual)		Recurring	7	3295	Important	GOAL E: Upgrading educational infrastructure	for one preventative maintenance (PM) and unlimited emergency repairs (our machine was purchased in 2014 for $24K); includes the diamond	Allows students access and training on relevant chemical technology	23
Vernier GC		One Time augmentation with maintenance and replacement at end of cycle	2	3000	Important	GOAL E: Upgrading educational infrastructure	Replacement of 2 currently broken GC's that are shared by 2 students in class/	Allows students access and training on relevant chemical technology	60
Vernier GC Syringe		Recurring	8	90	Important	GOAL E: Upgrading educational infrastructure	This is a replacement set of syringes. these needles are damaged when bent and have been in use for 7 years, they should be replaced as they break.	Allows students access and training on relevant chemical technology	72
Replacement sink strainers		One Time augmentation with maintenance and replacement at end of cycle	32	150	Important	GOAL E: Upgrading educational infrastructure	These rust over time and need regular replacement to keep the bench top sinks from getting damaged or clogged. (This might go through facilities but has been challenging to get previously.)	Chemical storage and student safety	

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Item	How Many	Approximate Cost (Each)	Importance Level
Nananalysis 100MHZ Multinuclear	1	155000	Critical
HPLC with Autosampler	2	51000	Critical Instrumentation Class/Important Normal
GC-MS with Autosampler	1	88000	Critical Instrumentation Class/Important Normal
Voltmeter	32	75	Important
Multi-channel micropippette	16	242.32	Important Instrumentation Class/Can Wait Normal
Single-channel micropippette	32	106	Critical Instrumentation Class/Important Normal
Nicolet IS5 ATR-IR	1	14880	Critical Instrumentation Class/Important Normal
Fisher Autotitrators	18	4000	Important
Hot/Stir Plates	32	550	Important
Schlenk Line	10	710	Important Instrumentation Class/Can Wait Normal
Rotovap (rotary evaporators)	10	7940	Critical Instrumentation Class/Important Normal
Sonicator	2	120	Can Wait
Refrigerator	2	5000	Can Wait
Dishwasher	1	11000	Can Wait
Combustion Analysis	1		Can Wait
Atomic Absorption	1	17850	Can Wait
Oven	1	1100	Can Wait
Bomb Calorimeter	1	4000	Can Wait
Ion Chromatography (anion)	1	29200	Critical Instrumentation Class/Important Normal
Microscale Kits for Organic	32	700	Important
Analytical Balance	8	4800	Can Wait
Top Loading Balance	24	2300	Can Wait
Chem 110 glassware set	96	150	Critical
Chem 100 Lab Kits	100	150	Critical
Vernier GC	7	3000	Important
Lab Quest Replacements is this what we want	32	400	Important
Lab Quest charger cables	10	18	Critical

pH probes for Chem 100	34		Can Wait
Pipette Pumps	32	100	Can Wait
Ultra Purifier for HPLC	1	6588	Critical Instrumentation Class/Important Normal
Viscometer	1	10,000	Can Wait
Rheometer	2-3	1300	Can Wait
Water Testing Kits/Instruments	2/year	25	Important
Actual Black Light Boxes	2	364	Important
NMR tube cleaner	3	234	Important
TLC Chambers without the middle lip (not jars)	32	147	Critical
TLC micropipettes	32	34	Critical
magnetic stir bars	100	5	Important
Plastic totes	36	20	Important
dedicated stockroom ipad/tablet/laptop and protective case	1-2	$2,000	Critical
Overhead stirrer for carboy with stand	1	1700	Can Wait
Stockroom micropipette set	1	750	Important
Color printer for IR	1	600	Important
Increase in instructional budget	1	5000	Important
Waste Budget (per year)	1	10000-20000	Important
General Maintenance Budget (per year)	1	10000	Important
Analytical Balance Calibration -annual	1	3700	Critical
Top loading balance calibration every 2 years	1		Critical
Chemventory Flinn Chemical Inventory System 5-year license	1	350	Important
Carboys for Stockroom (10 & 20L)	10	195	Important
Waste containers + funnels	40	200	Critical
Large Periodic Tables	2	220	Critical
Carrier Gasses for GC			Critical Instrumentation Class/Important Normal
Upkeep/Filters Ultra Purifier for HPLC	1	850	Important Instrumentation Class/Can Wait Normal
NMR tubes	1 (100 pack economy)	135	Important
deuterated CDCl3	1	$500	Important
deuterated DMSO	1	534	Important
O2 for combustion Analysis			
TLC plates - Box	2	50	Important
Metal Electrodes	32	30	Important
Set of lab coats or scrubs for safety showers	10	20	Critical
Set Cheap shoes for safety showers	15	10	Critical
Set Cheap shower curtains safety showers	5	5	Critical
Towels for safety showers	5	15	Critical
Chem 101 Take home kits	32	50	Critical
Pipette tips (1000 micropipette tips per bag)	10	54.03	Critical Instrumentation Class/Important Normal
Calibration for micropipettes (every 2-4 years)	50	30	Critical Instrumentation Class/Important Normal
Plastic chemical trays	20	30	Critical
Chem 101 lab kits	60	100	Critical
pH pens	40	90	Important
New/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	1	6800	Can Wait
IR Warranty (annual)	7	3295	Important
Vernier GC	2	3000	Important
Vernier GC Syringe	8	90	Important
Replacement sink strainers	32	200	Important

Cost estimate:

Item	How Many	Approximate Cost (Each)	Total Cost	Total Cost + 20%
Nananalysis 100MHZ Multinuclear	1	155000	155000	$186,000.00
HPLC with Autosampler	2	51000	102000	$122,400.00
GC-MS with Autosampler	1	88000	88000	$105,600.00
Voltmeter	32	75	2400	$2,880.00
Multi-channel micropipette	16	242.32	3877.12	$4,652.54
Single-channel micropipette	32	106	3392	$4,070.40
Nicolet IS5 ATR-IR	1	14880	14880	$17,856.00
Fisher Autotitrators	18	4000	72000	$86,400.00
Hot/Stir Plates	32	550	17600	$21,120.00
Schlenk Line	10	710	7100	$8,520.00
Rotovap (rotary evaporators)	10	7940	79400	$95,280.00
Sonicator	2	120	240	$288.00
Refrigerator	2	5000	10000	$12,000.00
Dishwasher	1	11000	11000	$13,200.00
Combustion Analysis	1		0	$0.00
Atomic Absorption	1	17850	17850	$21,420.00
Oven	1	1100	1100	$1,320.00
Bomb Calorimeter	1	4000	4000	$4,800.00
Ion Chromatography (anion)	1	29200	29200	$35,040.00
Microscale Kits for Organic	32	700	22400	$26,880.00

Analytical Balance	8	4800	38400	$46,080.00
Top Loading Balance	24	2300	55200	$66,240.00
Chem 110 glassware set	96	150	14400	$17,280.00
Chem 100 Lab Kits	100	150	15000	$18,000.00
Vernier GC	7	3000	21000	$25,200.00
Lab Quest Replacements is this what we want	32	400	12800	$15,360.00
Lab Quest charger cables	10	18	180	$216.00
pH probes for Chem 100	34		0	$0.00
Pipette Pumps	32	100	3200	$3,840.00
Ultra Purifier for HPLC	1	6588	6588	$7,905.60
Viscometer	1	10,000	10000	$12,000.00
Rheometer	2-3	1300	57973500	$69,568,200.00
Water Testing Kits/Instruments	20	25	500	$600.00
Actual Black Light Boxes	2	364	728	$873.60
NMR tube cleaner	3	234	702	$842.40
TLC Chambers without the middle lip (not jars)	32	147	4704	$5,644.80
TLC micropipettes	32	34	1088	$1,305.60
magnetic stir bars	100	5	500	$600.00
Plastic totes	36	20	720	$864.00
Dedicated stockroom iPad/tablet/laptop and protective case	1-2	$2,000	89126000	$106,951,200.00
Overhead stirrer for carboy with stand	1	1700	1700	$2,040.00
Stockroom micropipette set	1	750	750	$900.00
Color printer for IR	1	600	600	$720.00
			0	$0.00
Increase in instructional budget	1	5000	5000	$6,000.00
Waste Budget (per year)	1	10000-20000	#VALUE!	10,000-20,000 estimate
General Maintenance Budget (per year)	1	10000	10000	$12,000.00
Analytical Balance Calibration -annual	1	3700	3700	$4,440.00
Top loading balance calibration every 2 years	1		0	$0.00
Chemventory Flinn Chemical Inventory System 5-year license	1	350		$350.00
Carboys for Stockroom (10 & 20L)	10	195	1950	$2,340.00
Waste containers + funnels	40	200	8000	$9,600.00
Large Periodic Tables	2	220	440	$528.00
Carrier Gasses for GC			0	$0.00
Upkeep/Filters Ultra Purifier for HPLC	1	850	850	$1,020.00
NMR tubes	1	135	135	$162.00
deuterated CDCl3	1	$500	$500	$600.00
deuterated DMSO	1	534	534	$640.80
O2 for combustion Analysis			0	$0.00
TLC plates - Box	2	50	100	$120.00
Metal Electrodes	32	30	960	$1,152.00
Set of lab coats or scrubs for safety showers	10	20	200	$240.00
Set Cheap shoes for safety showers	15	10	150	$180.00
Set Cheap shower curtains safety showers	5	5	25	$30.00
Towels for safety showers	5	15	75	$90.00
Chem 101 Take home kits	32	50	1600	$1,920.00
Pipette tips (1000 micropipette tips per bag)	10	54.03	540.3	$648.36
Calibration for micropipettes (every 2-4 years)	50	30	1500	$1,800.00
Plastic chemical trays	20	30	600	$720.00
Chem 101 lab kits	60	100	6000	$7,200.00
pH pens	40	90	3600	$4,320.00
New/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	1	6800	6800	$8,160.00
IR Warranty (annual)	7	3295	23065	$27,678.00
Vernier GC	2	3000	6000	$7,200.00
Vernier GC Syringe	8	90	720	$864.00
Replacement sink strainers	32	150		200

Occurrence:

- Recurring expense
- One-time augmentation

Item	
Nananalysis 100MHZ Multinuclear	One Time augmentation with maintenance and replacement at end of cycle
HPLC with Autosampler	One Time augmentation with maintenance and replacement at end of cycle
GC-MS with Autosampler	One Time augmentation with maintenance and replacement at end of cycle
Voltmeter	One Time augmentation with maintenance and replacement at end of cycle
Multi-channel micropipette	Recurring
Single-channel micropipette	One Time augmentation with maintenance and replacement at end of cycle
Nicolet IS5 ATR-IR	One Time augmentation with maintenance and replacement at end of cycle
Fisher Autotitrators	One Time augmentation with maintenance and replacement at end of cycle
Hot/Stir Plates	One Time augmentation with maintenance and replacement at end of cycle

Schlenk Line	One Time augmentation with maintenance and replacement at end of cycle
Rotovap (rotary evaporators)	One Time augmentation with maintenance and replacement at end of cycle
Sonicator	One Time augmentation with maintenance and replacement at end of cycle
Refrigerator	One Time augmentation with maintenance and replacement at end of cycle
Dishwasher	One Time augmentation with maintenance and replacement at end of cycle
Combustion Analysis	One Time augmentation with maintenance and replacement at end of cycle
Atomic Absorption	One Time augmentation with maintenance and replacement at end of cycle
Oven	One Time augmentation with maintenance and replacement at end of cycle
Bomb Calorimeter	One Time augmentation with maintenance and replacement at end of cycle
Ion Chromatography (anion)	One Time augmentation with maintenance and replacement at end of cycle
Microscale Kits for Organic	One Time augmentation with maintenance and replacement at end of cycle
Analytical Balance	One Time augmentation with maintenance and replacement at end of cycle
Top Loading Balance	
Chem 110 glassware set	One Time augmentation with maintenance and replacement at end of cycle
Chem 100 Lab Kits	One Time augmentation with maintenance and replacement at end of cycle
Vernier GC	One Time augmentation with maintenance and replacement at end of cycle
Lab Quest Replacements is this what we want	One Time augmentation with maintenance and replacement at end of cycle
Lab Quest charger cables	One Time augmentation with maintenance and replacement at end of cycle
pH probes for Chem 100	One Time augmentation with maintenance and replacement at end of cycle
Pipette Pumps	One Time augmentation with maintenance and replacement at end of cycle
Ultra Purifier for HPLC	One Time augmentation with maintenance and replacement at end of cycle
Viscometer	One Time augmentation with maintenance and replacement at end of cycle
Rheometer	One Time augmentation with maintenance and replacement at end of cycle
Water Testing Kits/Instruments	Recurring
Actual Black Light Boxes	One Time augmentation with maintenance and replacement at end of cycle
NMR tube cleaner	One Time augmentation with maintenance and replacement at end of cycle
TLC Chambers without the middle lip (not jars)	One Time augmentation with maintenance and replacement at end of cycle
TLC micropipettes	Recurring
magnetic stir bars	One Time augmentation with maintenance and replacement at end of cycle
Plastic totes	One Time augmentation with maintenance and replacement at end of cycle
dedicated stockroom iPad/tablet/laptop and protective case	One Time augmentation with maintenance and replacement at end of cycle
Overhead stirrer for carboy with stand	One Time augmentation with maintenance and replacement at end of cycle
Stockroom micropipette set	One Time augmentation with maintenance and replacement at end of cycle
Color printer for IR	One Time augmentation with maintenance and replacement at end of cycle
Increase in instructional budget	Recurring
Waste Budget (per year)	Recurring
General Maintenance Budget (per year)	Recurring
Analytical Balance Calibration -annual	One Time augmentation with maintenance and replacement at end of cycle
Top loading balance calibration every 2 years	One Time augmentation with maintenance and replacement at end of cycle
Chemventory Flinn Chemical Inventory System 5-year license	Recurring
Carboys for Stockroom (10 & 20L)	One Time augmentation with maintenance and replacement at end of cycle
Waste containers + funnels	One Time augmentation with maintenance and replacement at end of cycle
Large Periodic Tables	One Time augmentation with maintenance and replacement at end of cycle
Carrier Gasses for GC	One Time augmentation with maintenance and replacement at end of cycle

Upkeep/Filters Ultra Purifier for HPLC	One Time augmentation with maintenance and replacement at end of cycle
NMR tubes	One Time augmentation with maintenance and replacement at end of cycle
Deuterated CDCl3	One Time augmentation with maintenance and replacement at end of cycle
Deuterated DMSO	Recurring
O2 for combustion Analysis	Recurring
TLC plates - Box	Recurring
Metal Electrodes	One Time augmentation with maintenance and replacement at end of cycle
Set of lab coats or scrubs for safety showers	Recurring
Set Cheap shoes for safety showers	Recurring
Set Cheap shower curtains safety showers	One Time augmentation with maintenance and replacement at end of cycle
Towels for safety showers	One Time augmentation with maintenance and replacement at end of cycle
Chem 101 Take home kits	Recurring
Pipette tips (1000 micropipette tips per bag)	One Time augmentation with maintenance and replacement at end of cycle
Calibration for micropipettes (every 2-4 years)	One Time augmentation with maintenance and replacement at end of cycle
Plastic chemical trays	One Time augmentation with maintenance and replacement at end of cycle
Chem 101 lab kits	Recurring
pH pens	One Time augmentation with maintenance and replacement at end of cycle
New/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	One Time augmentation with maintenance and replacement at end of cycle
IR Warranty (annual)	Recurring
Vernier GC	One Time augmentation with maintenance and replacement at end of cycle
Vernier GC Syringe	Recurring
Replacement sink strainers	One Time augmentation with maintenance and replacement at end of cycle

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value

Prioritized Resource Request Recommendations : Version by **Moskun, Amy** on **11/14/2022 04:06**

Item	Priority Level	How Many	Approximate Cost (Each)	Total Cost	Total Cost + 20%	Program Goal	Strategic Goal
New Lab Facility/Building Addition	Important	1				Increase laboratory space	
Venting Flammable/Corrosive Cabinets directly to fume hoods in 218C	Important	6		0	$0.00	Increase laboratory space	GOAL F: Enhancing organization effectiveness
			Faculty				
1st full time growth position	critical				salary	Hire and mentor additional full time faculty	Goal A: Strengthen the culture of completion
2nd full time growth position	important				salary	Hire and mentor additional full time faculty	Goal A: Strengthen the culture of completion
	Professional development						
Safety Training	critical					Improve safety training for students, full time faculty and part time faculty	GOAL E: Upgrading educational infrastructure
Industry partnerships and chemical instrumentation training	critical					Maintain current and develop new relationships with local chemical industry	GOAL B: Ensuring program alignment by strengthening partnerships
				0	$0.00		

Full-time Night Staff for Stock Room	Important	1	50k/year	#VALUE!	#VALUE!	Hire a second full-time stockroom technician and have adequate coverage of the stockroom	GOAL F: Enhancing organization effectiveness
Student worker to specifically assist with relabeling, lab kit prep, and clean out of storage areas	Important	1	15/hr	#VALUE!	#VALUE!	Hire a second full-time stockroom technician and have adequate coverage of the stockroom	GOAL E: Upgrading educational infrastructure
HPLC with Autosampler	Critical Instrumentation Class/Important Normal	2	51000	102000	$122,400.00	Develop chemistry technician certificate programAcquire chemical equipment for Chemistry Technician Certificate Program	GOAL B: Ensuring program alignment by strengthening partnerships
GC-MS with Autosampler	Critical Instrumentation Class/Important Normal	1	88000	88000	$105,600.00	Develop chemistry technician certificate programAcquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Voltmeter	Important	32	75	2400	$2,880.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Single-channel micropipette	Critical Instrumentation Class/Important Normal	32	106	3392	$4,070.40	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Nicolet IS5 ATR-IR	Critical Instrumentation Class/Important Normal	1	14880	14880	$17,856.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
iPads/pencils and cart	Important	1	40,000	40000	$48,000.00	Creation and implementation of online consumer chemistry general education course.	GOAL A: Strengthen the culture of completion
Multi-channel micropipette	Important Instrumentation Class/Can Wait Normal	16	242.32	3877.12	$4,652.54	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Chem 110 glassware set	Critical	96	150	14400	$17,280.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Chem 100 Lab Kits	Critical	100	150	15000	$18,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Nananalysis 100MHZ Multinuclear	Critical	1	155000	155000	$186,000.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Lab Quest charger cables	Critical	10	18	180	$216.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
TLC Chambers without the middle lip (not jars)	Critical	32	147	4704	$5,644.80	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
TLC micropipettes	Critical	32	34	1088	$1,305.60	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
dedicated stockroom ipad/tablet/laptop and protective case	Critical	1-2	$2,000	89126000	$106,951,200.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Analytical Balance Calibration -annual	Critical	1	3700	3700	$4,440.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Top loading balance calibration every 2 years	Critical	1		0	$0.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Waste containers + funnels	Critical	40	200	8000	$9,600.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Large Periodic Tables	Critical	2	220	440	$528.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Set of lab coats or scrubs for safety showers	Critical	10	20	200	$240.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Set Cheap shoes for safety showers	Critical	15	10	150	$180.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Set Cheap shower curtains safety showers	Critical	5	5	25	$30.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Towels for safety showers	Critical	5	15	75	$90.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Chem 101 Take home kits	Critical	32	50	1600	$1,920.00	Creation and implementation of online consumer chemistry general education course.	GOAL F: Enhancing organization effectiveness
Plastic chemical trays	Critical	20	30	600	$720.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Chem 101 lab kits	Critical	60	100	6000	$7,200.00	Creation and implementation of online consumer chemistry general education course.	GOAL A: Strengthen the culture of completion
Ultra Purifier for HPLC	Critical Instrumentation Class/Important Normal	1	6588	6588	$7,905.60	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Pipette tips (1000 micropipette tips per bag)	Critical Instrumentation Class/Important Normal	10	54.03	540.3	$648.36	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Calibration for micropipettes (every 2-4 years)	Critical Instrumentation Class/Important Normal	50	30	1500	$1,800.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure

Rotovap (rotary evaporators)	Critical Instrumentation Class/Important Normal	10	7940	79400	$95,280.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Ion Chromatography (anion)	Critical Instrumentation Class/Important Normal	1	29200	29200	$35,040.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Carrier Gasses for GC	Critical Instrumentation Class/Important Normal			0	$0.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL A: Strengthen the culture of completion
Hot/Stir Plates	Important	32	550	17600	$21,120.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Chem Draw Prime (Perpetual License)	Important	4	2260	9040	$10,848.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Microscale Kits for Organic	Important	32	700	22400	$26,880.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Vernier GC	Important	7	3000	21000	$25,200.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Lab Quest Replacements is this what we want	Important	32	400	12800	$15,360.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL A: Strengthen the culture of completion
Water Testing Kits/Instruments	Important	2/year	25	#VALUE!	#VALUE!	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Actual Black Light Boxes	Important	2	364	728	$873.60	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
NMR tube cleaner	Important	3	234	702	$842.40	Acquire chemical equipment for Chemistry Technician Certificate Program	
magnetic stir bars	Important	100	5	500	$600.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Plastic totes	Important	36	20	720	$864.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Stockroom micropipette set	Important	1	750	750	$900.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Color printer for IR	Important	1	600	600	$720.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Increase in instructional budget	Important	1	5000	5000	$6,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Waste Budget (per year)	Important	1	20000	20000	$20,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
General Maintenance Budget (per year)	Important	1	10000	10000	$12,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Chemventory Flinn Chemical Inventory System 5-year license	Important	1	350	350	$350.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
Carboys for Stockroom (10 & 20L)	Important	10	195	1950	$2,340.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness
NMR tubes	Important	1 (100 pack economy)	135	#VALUE!	#VALUE!	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL A: Strengthen the culture of completion
Deuterated CDCl3	Important	1	$500	$500	$600.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL A: Strengthen the culture of completion
Deuterated DMSO	Important	1	534	534	$640.80	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL A: Strengthen the culture of completion
TLC plates - Box	Important	2	50	100	$120.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Metal Electrodes	Important	32	30	960	$1,152.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Spartan/Odyssey Software - Site License	Important	1	2500	2500	$3,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
pH pens	Important	40	90	3600	$4,320.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
IR Warranty (annual)	Important	7	3295	23065	$27,678.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Vernier GC	Important	2	3000	6000	$7,200.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Vernier GC Syringe	Important	8	90	720	$864.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Schlenk Line	Important Instrumentation Class/Can Wait Normal	10	710	7100	$8,520.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Upkeep/Filters Ultra Purifier for HPLC	Important Instrumentation Class/Can Wait Normal	1	850	850	$1,020.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
New/spare diamond for IR (https://drive.google.com/file/d/1H_rhsvurz3p5qMjpBhk5ogGGTW71jG48/view?usp=sharing)	Can Wait	1	6800	6800	$8,160.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
pH probes for Chem 100	Can Wait	34		0	$0.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	
Pipette Pumps	Can Wait	32	100	3200	$3,840.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
O2 for combustion Analysis	Can Wait			0	$0.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	
Overhead stirrer for carboy with stand	Can Wait	1	1700	1700	$2,040.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL F: Enhancing organization effectiveness

Sonicator	Can Wait	2	120	240	$288.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Refrigerator	Can Wait	2	5000	10000	$12,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Dishwasher	Can Wait	1	11000	11000	$13,200.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Combustion Analysis	Can Wait	1		0	$0.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Atomic Absorption	Can Wait	1	17850	17850	$21,420.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL A: Strengthen the culture of completion
Oven	Can Wait	1	1100	1100	$1,320.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Bomb Calorimeter	Can Wait	1	4000	4000	$4,800.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Replacement sink strainers	Can Wait	32	150			Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Viscometer	Can Wait	1	10,000	10000	$12,000.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Rheometer	Can Wait	2-3	1300	57973500	$69,568,200.00	Acquire chemical equipment for Chemistry Technician Certificate Program	GOAL E: Upgrading educational infrastructure
Analytical Balance	Can Wait	8	4800	38400	$46,080.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Top Loading Balance	Can Wait	24	2300	55200	$66,240.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure
Replacement ipads Class set 32	Can Wait	2	$40,000	$80,000	$96,000.00	Provide a very high quality chemical education to our students so that they are highly prepared for transfer, scientific research, graduate school and/or the workforce in a STEM career	GOAL E: Upgrading educational infrastructure

Resource request:	Priority:	Cost estimate:	Program goal alignment:
undefined	undefined	undefined	undefined