SANTA MONICA COLLEGE
PHYSICAL SCIENCES DEPARTMENT
SIX-YEAR PROGRAM REVIEW

2019-2020

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A. Description and Goals

1. Describe the program and/or service area under review and how the program supports the mission of Santa Monica College.

The Physical Sciences Department at SMC houses three distinct disciplines: Chemistry, Physics, and Engineering. Every academic year, we offer close to three hundred sections of twenty-six unique courses to approximately 4500 students corresponding to more than 1100 weekly teacher hours. We have consistently ranked as the fourth largest department on campus from a variety of measures.

Over ninety percent of our students are fulfilling prerequisites and/or General Education science requirements in preparation for transfer into four-year university programs or entry into professional programs.

The Department supports the College's mission very directly by offering rigorous courses combined with plenty of support that prepares student for success upon transfer, in graduate and professional schools, or in future careers. Our high quality instruction ensures that our students leave SMC with the knowledge, skills, and confidence to compete successfully with university students nationwide.

We have designed our curriculum to meet the needs of a variety of student interests and goals in each discipline.

Chemistry curriculum

1. *Chemistry 9* was developed to address the needs of nonscience majors who need to complete their General Education requirement.
2. *Chemistry 10* is an introductory course popular as preparation for entry into Chemistry 11 and STEM majors. It is the most highly enrolled science course offered at SMC.
3. *Chemistry 19* was offered starting Fall 2016 to more directly address the demand from Pre-Nursing and other Pre-Allied Health programs. Chemistry 19 covers the fundamental of General, Organic, and Biological Chemistry.
4. *Chemistry 11, 12, 21, 22 and 24* make up the first two years of university level chemistry: a year of general chemistry and a year of organic chemistry along with the accompanying laboratory work.
5. *Chemistry 31* serves transfer students majoring in biochemistry or related disciplines as well as post-baccalaureate students who intend to apply to professional schools in medicine, pharmacy, and related fields.

Physics curriculum

1. *Physics 12 and 14* offer nonscience majors a conceptual view of the principles of Physics. Physics 14 has a laboratory component, while Physics 12 does not.
2. *Physics 6 and 7* treat the principles of physics using algebra and trigonometry instead

of calculus. The series serves students in life science and other majors that do not require a calculus-based physics background.

3. *Physics 8 and 9* comprise a one-year calculus-based Physics series and are designed to meet the needs of students in non-engineering majors.
4. *Physics 21, 22, 23 and 24* comprise our most rigorous, calculus-based course sequence in physics and serve those planning to transfer with majors in engineering or the physical sciences.
5. *Physics 20* is a new course first offered in spring 2019 that was designed to prepare students who plan to take Physics 8 or Physics 21.

Engineering curriculum

1. *Engineering 1* is an introductory course designed to educate the students about the field and introduce them to engineering design principles.
2. *Engineering 11* is primarily designed to serve Mechanical Engineering students and covers engineering drawing and design principles.
3. *Engineering 12 and 16* covers static and dynamic systems, respectively. They are capstone courses for students transferring into Mechanical Engineering and similar programs.
4. *Engineering 21 and 22* comprise a lecture and lab Electrical Engineering sequence that teaches students circuit analysis and circuit design.

Lastly, both our chemistry and physics faculty members also teach *Science 10*, an introductory course in research methods taken primarily by students in the SMC STEM Program. Beyond learning practical scientific research methodologies, the course also prepares students to work as summer undergraduate researchers at UCLA as part of the continuing collaboration between the SMC STEM Program and UCLA.

2. Identify the overarching goal(s) or charge/responsibilities of the program or service area. If appropriate, include ensuring/monitoring compliance with state, federal or other mandates.

Our students come in four groups:

1. Those majoring in STEM, physical sciences, engineering or related disciplines and planning to transfer to a four-year university.
2. Those preparing to apply to professional schools such as medical, dental, or pharmacy schools.
3. Those preparing to enter the allied-health profession such as nursing, physician assistant, or physical therapy.
4. Those who are taking our classes to satisfy a general education requirement.

For students in the first three groups, our overarching goal is to provide rigorous academic preparation that will serve them well beyond their time at SMC.

For the last group of students, we aim to increase their science literacy and critical thinking skills so they can become more productive citizens.

3. If applicable, describe how the Institutional Learning Outcomes (ILOs), Supporting Goals, and/or Strategic Initiatives of the institution are integrated into the goals of the program or service area.

In Table 1, the department's overarching goals are further broken down to specific goals, each of which directly connects to the College's ILOs and/or Supporting Goals.

Table 1

List of Department Goals, the corresponding ILOs, and Supporting Goals

Program Goal	College's ILO	College's Supporting Goals
Preparing students for transfer into and completion of four-year university programs	*ILO 1 - Personal Attributes*	*Innovative and Responsive Academic Environment*
Providing students with a thorough foundation in the principles of science, the relevance of those principles to today's world, and their critical importance in society's quest to solve global environmental challenges	*ILO 2 - Analytic and Communication Skills* *ILO 4 - Applied Knowledge and Valuation of the Physical World* *ILO 5 - Authentic Engagement*	*Innovative and Responsive Academic Environment*
Developing students' critical thinking/problem solving skills through analysis of empirical evidence and the importance of integrity in scientific pursuits	*ILO 1-Personal Attributes* *ILO 2 - Analytic and Communication Skills*	*Innovative and Responsive Academic Environment*
Increasing participation, retention, success, and transfer rates of underrepresented student populations in the physical sciences	*ILO 3 – Applied Social Knowledge and Values*	*Innovative and Responsive Academic Environment* *Supportive Collegial Environment*

Ensuring that the department's courses articulate to baccalaureate-granting institutions, prepares students for standardized admission exams (MCAT, DAT, etc), and fulfills entrance requirements for professional and allied-health programs.		*Innovative and Responsive Academic Environment*
Instilling the importance of and providing a safe laboratory environment for students, faculty, and staff that complies with OSHA and Cal OSHA mandates	*ILO 5 - Authentic Engagement*	*Sustainable Physical Environment* *Supportive Collegial Environment*
Maintaining high quality scientific instrumentation and laboratory facilities and maximizing student exposure to and use of those resources	*ILO 2 - Analytic and Communication Skills*	*Innovative and Responsive Academic Environment* *Sustainable Physical Environment*
Providing effective mentorship and professional development opportunities for all, but especially for new faculty and staff.		*Supportive Collegial Environment*

4. If your program receives operating funding from any source other than District funds, identify the funding source. If applicable, note the start and end dates of the funding (generally a grant), the percentage of the program budget supported by non-District funding, and list any staff positions funded wholly or in part by non-District funds. Do not include awards for non-operational items such as equipment (ex. VTEA) or value-added activities (ex. Margin of Excellence).

The department is funded fully by the District, but in recent years has also received additional funding from the HSI STEM Grants. Briefly, SMC has received three STEM Grants: in 2011 (first phase), in 2016 (second phase), and in 2019 (third phase). The three grants support the creation and continuing operation of the Science and Research Initiative (SRI) Program at SMC. The SRI program annually recruits over 150 students, primarily from underrepresented population in the sciences, who are interested in pursuing a career in STEM.

The first phase of the grant helped to fund Supplemental Instruction (SI) in the department's gateway courses, Chem 10, 11, 12, and Physics 21. The same grant also supported the development of Science 10, a new course that teaches scientific research principles and practice to students. The second phase of the grant helped to support the creation of Physics 20, a course to prepare students for entering calculus-based Physics (Physics 8 or 21). In addition, the grant helped support much-needed reassigned time for our Engineering faculty member to develop new courses and create a more robust Engineering program. Last but certainly not least, the grant also helps to pay for the renovation of Drescher 109 which is slated to be the future Engineering maker space.

A separate NASA MUREP Community College Curriculum Improvement (MC3I) grant was used to support curriculum development during the period from October 2015 to October 2018. The combination of the NASA MUREP and the second phase HSI-STEM grant was also used to build a new computer lab for the Engineering program located in Drescher 305.

Continued development and support of the engineering program are also funded by partnerships between UCLA and SMC, which includes grants from the Office of Naval Research Grant and the Teagle Foundation.

Lastly, the first two phases of the HSI STEM grants also help support faculty members who conduct the Chemistry 10 Bootcamp, an academic support program for students taking the first course in the chemistry sequence.

B. Populations Served

1. Describe your students in terms of ethnicity, race, gender, age, residency status, citizenship, educational goal, enrollment status, and full/part-time status. Note any changes in student or enrollment data since the last six-year program review and the possible reasons for the changes.

To preserve the flow of the narrative, most supporting materials, including tables and figures, are located in the Appendix section in the order that they appear in the text.

Due to the multi-disciplinary nature of the Physical Sciences department, we anticipate some differences in the statistics across disciplines and specific courses in the department. To cite one example, even though half of the department's enrollment is females, their number in Physics (35%) is significantly lower than Chemistry (55%).

To address these discipline- and course-specific trends, faculty members in the department have also analyzed course-level data provided by the Institutional Research (IR) Tableau Dashboard. In cases where *significant differences* exist between departmental and course-level data, course-specific discussion will follow a description of departmental results.

Physical Sciences Department Data

Below is an approximate breakdown of the student population currently enrolling in Physical Science Department courses based on 2018-19 data. Our students are:

- 50% female;
- Predominantly (78% under 24 and 14% between 25-29) under 30 years of age;
- 77% CA residents, 7% non-CA residents, and 15% F-1 students;
- 19% Asian, 5% Black, 36% Latinx, 26% White, and 5% multiracial;
- 61% continuing students, 16% first time freshmen, 13% first time at SMC, and 9% returning;
- 80% planning to transfer and 11% comprised of 4-year student, career objective, and educational development;
- 87% high school graduates and 12% already possessing a bachelor's degree;
- 50% full-time students;
- 21% at the basic skills level in math and/or English.
- 51% on financial aid.

We observed the following patterns when comparing departmental data over the past six academic years (2013-14 to 2018-19):

1. The department's enrollment has increased by about 5% (Appendix I, Table 2). This is likely due to efforts by SMC's SRI Program to recruit students into STEM majors which began in the 2012-13 academic year. Another possible reason is that starting 2013, the State Board of Education adopted the Next Generation of Science Standards (NGSS) for California K-12 Public Schools. This has resulted in increased funding statewide for STEM education, which undoubtedly helps to steer students into the majors.

2. In support of our hypothesis, Table 3a (Appendix I) shows large increases in the number of first-time freshmen and first-time-to-SMC students coming into the department. These increases more than made up for the loss in the number of continuing students.

3. Table 4 (Appendix I) shows that our department's decrease in F-1 student enrollment is a mere 3 out of 673 students. This was in contrast to our last six-year Program Review where we observed a 4% decrease. It is important to note however, that a 24% decrease in F-1 student enrollment took place within the last three years, which coincided with the rising trade tensions between the current U.S. administration and the Chinese government.

4. The department's Latinx and African American student enrollment shows a dramatic 22% (Appendix I, Table 5) and 25% (Appendix I, Table 6) increase, respectively. These increases are likely the results of continuous efforts to recruit and retain these students as part of the college's STEM initiatives.

5. In contrast, there is a 6% drop in Asian P/I student enrollment over the past six years (Appendix I, Table 7), many of whom we have reasons to believe are F-1 students from China. Since the drop started three years ago, it coincided with a similar drop observed for the College.

Before we delve into course-level discussions, it is useful to know that the Physical Sciences department combines specific courses to form a "program", an arrangement that has existed for at least twenty years. Typically, one FT faculty member (called the program leader) oversees each program and organizes regular meetings attended by other program faculty. The current list of programs are listed in Table 10.

Table 10

List of Programs in the Physical Sciences Department in the 2018-2019 Academic Year

Program and Course(s)	Number of Students
Introductory Chemistry	
Chem 9 (Non-Major Chemistry)	372
Chem 10 (Introductory Chemistry)	1766
General Chemistry (Chem 11 and 12)	1315
Organic and Biological Chemistry	
Chem 19 (Pre-Nursing and Pre-Allied Health)	283
Chem 21, 22, 24 (Organic Chemistry)	425
Chem 31 (Biochemistry)	20
Physics and Engineering	
Physics 12 and 14 (Conceptual Physics)	341
Physics 6 and 7 (Algebra-based)	258
Physics 8 and 9 (Calculus-based)	158
Physics 21, 22, 23, and 24 (Physics for Engineers)	808
Engineering	150

Introductory Chemistry Program

Increase in the number of F-1 students had led to a 50%, or 124-students, enrollment growth in Chem 9 over the past six years. Because most of these F-1 students are from mainland China, the Asian P/I group comprises 41% of Chem 9 students, while Latinx students represent only 21%. These numbers are almost the exact opposite of what we observed for the department.

As might be expected, the college-wide 14% drop in F-1 student enrollment in the past three years (Appendix I, Table 4) affected the Chem 9 program more severely than other programs in the department. We see a 15% decrease in the total enrollment of Chem 9 since 2016-2017 (data not shown) compared to the department's 4% drop (Appendix I, Table 2). Beyond the drop in the actual number of F-1 students enrolled at SMC, Chem 9 specifically was one of the courses in the College where we had more incidents of academic dishonesty. We were informed that a number of Chem 9 seats were for sale in WeChat, the social medial platform used often by mainland Chinese students. These cheating and seat-for-sale incidents were all reported to Student Judicial Affairs. In addition, the department also started to change the Chem 9 instructors and we immediately saw a drop in enrollment.

Total enrollment for Chem 10 in 2018-19 dropped by about 4% or 74 students compared to six years ago. This corresponds to fewer than three sections of the class. The decrease seems to result from two factors: a small number of pre-Allied Health students choosing to take Chem 19 and the decrease in the number of continuing student enrollment seen across the department. In Chem 10 the number of continuing students shows a 30% decrease or 359 fewer students (Appendix I, Table 8), compared to the 6% drop observed for the department. Partly, this may be the result of more students deciding to take the Chem 10 Challenge Exam and bypassing the course altogether. The good news is that, as Table 8 shows, the increase in first-time freshmen, first-time to SMC students, and returning students in Chem 10 makes up for most of these losses.

As noted in our previous six-year review, Chem 10 also enrolls a higher percentage of Latinx students than the department; 42% versus 36%, respectively in the 2018-2019 academic year. This is because Chem 10 is a gateway course to STEM majors and almost everyone interested in majoring in STEM has to take the class.

General Chemistry Program

The trends for General Chemistry mimic the departmental results discussed above. Of note, the percentage of full-time student enrollment, at 58% and 64% for Chem 11 and 12, respectively is higher than that of the department. Possible explanations include:

1. These are more rigorous courses which require a more substantial time commitment.
2. The program has on average 9% more "under 20" group of students compared to the department. Since younger students often have fewer personal obligation, they are more likely to be full-time students.
3. A slightly higher percentage, 53.1% in 2017/18, of Chem 11 students have financial aid compared to 51% for the department, which enables them to be enrolled full-time.

Organic and Biological Chemistry Program

Chem 19 was first offered in Fall 2016 so the discussion only applies to data collected in the last three years. The course was created to serve the specific needs of pre-Nursing and other pre-Allied Health students. These students had previously been taking Chem 10 to satisfy their prerequisite for Nursing or other Allied Health majors.

Since its inception until now, Chem 19 has seen an explosion in enrollment, increasing by 89% or 133 students during the period. There is a continuous request from students to offer more sections. For Spring 2020, we offer two more sections compared to the prior year and they are over 90% filled before the start of the term.

The make-up of Chem 19 students is quite distinct from the department as a whole.

1. Latinx and African American students make up 50% and 10% of the student population, compared to the department's percentage of 36% and 5%, respectively.
2. Female students (77.4%) outnumber male students (22.4 %) by about 3.5-to-1.
3. 90% of the students are California residents, with only 3% being F-1 students.
4. About two thirds of Chem 19 students are on financial aid and 61% are FT.
5. A little more than a quarter of the students are categorized as Basic Skills.

Due to the unique characteristics of Chem 19 students, we plan to offer a number of course-specific support services to these students. We discuss these supports in section G.

The Organic Chemistry series (Chem 21, 22, and 24) is the department's equivalent to the standard second year chemistry sequence and serve as capstone courses for students majoring in Chemistry and related disciplines. Over the six-year period, enrollment has decreased by 18% in the first two courses and 38% in Chem 24, requiring the department to schedule fewer sections of Chem 24. Due to the capstone nature of these courses however, faculty members in the program feel strongly that enough sections of Chem 22 and Chem 24 continue to be offered at reasonable times so that students can finish their transfer requirements.

Chemistry 31 is the highest-level chemistry course offered by the department. Enrollment has decreased by 63% over the review period. The department has responded by scheduling fewer and fewer sections down to only one section per year since 2017. We had asked two nearby community colleges that offer the same course and both indicated that they also observed a drop in their enrollment.

The following are possible reasons for the decreased enrollment:

1. In the past few years, three of the LACC colleges had started to offer the same course resulting in increased competition for students.
2. Many pharmacy schools require their applicants to complete one semester of biochemistry. A drop in the number of pre-pharmacy students in recent years will result in a drop in Chem 31 enrollment.
3. More students majoring in biochemistry or related disciplines decide to take the class after they transfer.

Physics Discipline Overall

Unlike the Chemistry discipline where historically faculty members attend only the specific program in which their courses are part of (see Table 10), Physics and Engineering faculty typically meet together due to the relatively smaller number of FT faculty in these disciplines. Each full-time Physics/Engineering faculty member takes on the role of coordinating a specific course (or set of courses) within the overall program. The discussion on Physics therefore can be further divided into these sub-programs.

The Physics program as a whole saw a 9% decrease in enrollment in the six-year period, which seems to be in keeping with College-wide trend, although not necessarily with the department. Within the program however, specific courses have upward and downward trends. We will discuss these further as we break down the discipline below.

Although the number of Asian students in Physics is also decreasing as we have observed elsewhere, they still comprise a larger percentage (29%, data not shown) of the total Physics students when compared to their relative percentage in the department (20%). It is likely that most of these students are F-1 students since there is 27% of Physics students who come from a foreign country (data not shown).

Another item to note is the gender gap in Physics, where only 20% of female students enroll. This trend is consistent with nationwide data where over the 2007 – 2017 period, female students earned only an average of 20% of all the Bachelor degrees in Physics (data from American Physical Society).

Conceptual Physics Program

Over the past 6 years, the numbers of sections offered in Physics 12 and 14 have shrunk quite drastically by 18% and 51%, respectively. Over the same period, the number of Asian/Pacific Islander students enrolled also decreased dramatically. This seems to be due to a combination of three factors. Because many of the Asian/PI students are F-1 students, the drop is likely correlated to the college-wide decrease in F-1 enrollment. Secondly, these courses suffer from the same cheating rings found in Chem 9 as described previously. Once the department took notice and started to change the instructors in these courses, enrollment started to drop. Lastly, we also think that non-science majors may have found other science courses that can fulfill their general education requirements.

General Physics Program

Physics 6 shows a 14% drop in enrollment, in contrast to the 40% increase in the Physics 7 enrollment. This results in the number of Physics 7 students relative to Physics 6 students increasing from 24% in 2013-14 to 39% for 2018-19 (Table 9). During this same period, we observed a gradually decreasing enrollment in Physics 9, the second semester of our Calculus-based General Physics.

We think that one possible reason may be that some pre-medical students take calculus-based physics in their first semester (Physics 8) and decide to take algebra-based physics for the second semester (Physics 7). This is not uncommon as four-year universities typically recommend their pre-medical students do so based on the increased difficulty of the second semester general physics curriculum. A search of four-year institutions revealed that this practice is recommended at UC Berkeley and UCLA.

It is also possible that universities have relaxed their transfer requirements in general, so that students choose to take Physics 7 for their second semester Physics instead of the more difficult, Calculus-based Physics 9.

Another significant change observed in Physics 6 is the decline in the percentage of White and Asian students with the concomitant growth in the Latinx population. As discussed before, the STEM Program is likely responsible for this trend.

Recently, anecdotal evidence suggests that Computer Science majors are now taking the Physics 8 and 9 series. We are thinking about surveying Physics 8 and 9 students in future semesters to get a better idea of the academic goals of students in these courses.

Physics for Engineers Program
The notable trend here is in the increase in enrollment of Physics 21 (13%) and Physics 22 (40%). Both of these increases correlate with the implementation of phase 2 of the HSI STEM grant (section A.4.) which is specifically geared towards increasing the number of Engineering students.

As discussed for the Physics discipline overall, female students are largely under-represented in these classes, making up only about 20% of the student population. We hope that the recent addition of two female faculty members in Physics and Engineering will help provide role models for female students who are interested in pursuing a degree in Physics.

The STEM grant, whose goal is to increase the number under-represented groups, has been quite successful as evidenced by the 32% and 83% increase in the number of Latinx students in Physics 21 and 22, respectively. In Physics 21, the number of African American students increased by 36%, while in Physics 22, the number of African American students went from zero to nine in the past six years.

The Asian P/I population has dropped relative to other ethnic groups, but is still the largest group at roughly a third of the students for the Engineering Physics series. We note that the Asian P/I group also increases their numbers over the past six years, but its rate of change is smaller compared to the Latinx and African American groups. Lastly, White students are at about 20% of the total enrollment.

Engineering Program
Within the last six years, the engineering program has seen a seismic change in enrollment and course offerings. Enrollment has gone up by 121% (82 students) and the program went from offering two to now having six distinct courses for students.

Before Fall 2016, only Engineering 12 was consistently offered, with Engineering 16 offered but regularly cancelled due to low enrollment. Both classes are upper-level engineering courses that require completion of Math 7 and Physics 21 to enroll. Fall 2016 saw the addition of four new courses. There are now two courses for beginning students: Engineering 1, which teaches an overview of the Engineering field and Engineering 11, which teaches computer-aided design in Engineering. The other two are higher level courses, Engineering 21 and 22. They are designed for students interested in Electrical Engineering who have completed Math 15 and Physics 22.

To fairly represent the significant change occurring in Fall 2016, the data for Engineering have been aggregated into percent distributions for: the six-year span of the Engineering program (ENGR total in Table 11), before the new courses were introduced (ENGR pre-2016 in Table 11), and after the new courses were introduced (ENGR post-2016 in Table 11). In addition, the college data are presented for comparison.

Table 11

Student Enrollment for the Engineering Program by Gender and Ethnicity

	SMC	ENGR total	ENGR pre-2016	ENGR post-2016
Female	54%	18%	15%	21%
Male	46%	82%	85%	79%
Asian P/I	14%	17%	17%	16%
African American	9%	8%	11%	6%
Latinx	37%	34%	30%	39%
Two or more	4%	5%	5%	5%
Unknown	6%	10%	9%	10%
White	29%	26%	28%	25%

The addition of the new classes saw an added increase in proportion of students who either identify as Latinx or Female. This is mostly due to the addition of Engineering 1 because for both demographics, their population in Engineering 1 is much greater when compared to their numbers in Engineering 12 pre-2016 (data not shown).

2. Compare your student population with the college demographic. Are your students different from the college population?

Physical Sciences Department Data

The following patterns are observed when we compare Physical Sciences department data to the College from Fall 2013 to Spring 2019:

1. The department's enrollment has *increased* by about 5% while the College's enrollment has *dropped* by roughly 2% (Appendix I, Table 2). As described, efforts to promote STEM fields both at SMC and statewide are likely reasons for this contrasting enrollment numbers.

2. The department's 6% drop in continuing-student enrollment (Appendix I, Table 3a) mirrors the 7% decrease experienced by the College (Appendix I, Table 3b). Due to the interest in STEM fields though, we observed 36% and 32% increases in the number of first-time freshmen and first time to SMC students, respectively who are enrolling in the department. In contrast, during the same period the College's number of first-time freshmen and first-time-to-SMC enrollment drops by 10% and 4%, respectively.

3. Since 2013, we saw a 13% drop of F-1 student enrollment for the College, while the department experienced no significant change (Table 4). A closer look however, showed that the department's F-1 enrollment has fluctuated more dramatically than the College's. This indicates that more F-1 students are taking our courses, primarily Chem 9, Physics 12, and Physics 14. Swings in F-1 student enrollment will impact enrollment in these classes greatly.

4. The department's 22% increase in Latinx student enrollment contrasts to the College's 5% increase (Table 5). This much higher rate results in Latinx students currently making up 36% of the department's total student population. If the rate continues, the department's Latinx student proportion will soon mirror the 38% exhibited by the College. Note that our Engineering program already shows a 39% Latinx enrollment (Table 11).

5. Similarly, the department sees a 25% increase in the enrollment of African American students, while in the same period the College shows a 9% drop (Table 6). Although the number of African American students in the department is still only 5.4% of the total student enrolled, their number is slowly approaching the 8.9% observed for the College. Taken together, the increase in Latinx and African American student enrollment suggests that the outreach made by the SRI Program to students who are traditionally underrepresented in the Physical Sciences is bearing fruit.

6. The department saw a 6% drop as the College experienced a 15% decrease in Asian P/I student enrollment (Table 7). Despite this drop, Asian P/I students are still overrepresented in the Physical Sciences as they make up roughly 20% of the department compared to only 12.5% of the College's total student population. It is possible that the drop in the Asian P/I population is linked to the decrease in the number of enrollment of F-1 students from China. In support of this notion, the drop occurred only in the last three years, coinciding with the decrease in F-1 student enrollment college-wide. Additionally, consultation with Denise Kinsella, Interim Dean of International Education, confirmed that the largest number of F-1 students who declared either General Science or Engineering as majors are from China.

7. Full-time Student Enrollment in the department continues to be much stronger compared to the College (data not shown). In the past six years, the department's full-time student enrollment averages 50%, while the College's is around 22%. This is likely because the academic workload of students who major in Physical Sciences requires that they attend the College as full-time students.

Individual program data are very much in line with the departmental observations listed above. We describe specific differences in section B.1. and will not repeat them here.

3. What percentage of students in your program place in basic skills and, if applicable, how does this impact your program goals and/or curriculum?

In our last six-year review, the number of basic skills students was listed as 3% of the department's total student population. However, based on Institutional Research data spanning the past six years, the percentage of basic skills students in the department has always been slightly more than 20% (Table 10). Based on consultation with the Dean of Institutional Research, Hannah Lawler, this discrepancy seems to result from the slight change in the way basic skills students are counted. In 2013-2014, a basic skills student in the department at a given term was a student who concurrently enrolled in at least one basic skills course *and* one course in Physical Sciences. The current definition that is used in Tableau is a student who took a Physical Sciences course in one term and a basic skills course, whether in the same term or any other term. The latter definition results in a larger and more consistent number of basic skills students.

Based on the current definition, basic skills students make up about one-fifth of the department's enrollment. As a result, it is important that the department now thinks about the type of support services to provide to these students. To this end, we first have to identify where the basic skills students are most concentrated in and secondly, we have to determine the courses where their success rate is lowest.

A number of our courses either do not have math prerequisites or have math prerequisites that are considered basic skills, i.e. Math 20 or lower. It is reasonable to expect that most of our basic skills students will be concentrated in these courses, which include Chem 9, Chem 10, Chem 11, Chem 19, Physics 12, Physics 14, and Engineering 1. When we analyzed the data, it seems clear the basic skills students in Chem 10, Chem 11, and Chem 19 are passing at a significantly lower rate compared to those in the other courses (data not shown). This is most likely because these courses require a substantial mastery of math to pass. Thus, our discussion of basic skills students will center mostly on these three courses.

Table 12 shows that approximately 40%, 22%, and 27% of students in Chem 10, Chem 11, and Chem 19, respectively are basic skills students. If we look at the success rates of basic versus non-basic skills students, we see a clear gap. For Chem 10 and Chem 11, only about 45% of basic skills students pass these courses, while for Chem 19, the passing rate is a disappointing 34%. In contrast, approximately 65% of non-basic skills student passed Chem 10 and Chem 11, and about 57% passed Chem 19. In section D, we will discuss some of the steps we had taken and plan to incorporate to address this discrepancy in performance between the two groups of students.

As Table 10 shows, we see an 8% reduction in the number of basic skills students in the department, while the College shows a 26% decrease in the six-year period. Based on the explanation by Dean Lawler, this reduction is a result of a legal requirement to reduce the number of basic skills students in the College. Consequently, we do not attribute this decrease to a specific departmental initiative.

C. Program Evaluation

1. List the specific SLOs your program or discipline has chosen to focus on this year for discussion of program improvement.

SLOs are specific, measurable statements of 'what a student should know, be able to do, or value when they complete a course'. An SLO focuses on specific knowledge, attitudes, or behaviors that students will demonstrate or possess as a result of instruction.

Physical Sciences Department

The various courses in the department asses an average of three SLOs every semester and the faculty involved in these courses meet during the semester to discuss the assessment results and any program changes that may be needed. Typically, SLO discussions focus on why students did poorly on specific SLOs, and what pedagogical changes should be implemented to improve their performance.

Rather than list each course SLOs as we did in our previous program review, we chose to list the general principles that make up our SLOs as well as a few examples of how these SLOs are measured. A list of the specific SLOs for all our courses is still available in Appendix II.

Chemistry Discipline

In general, the Chemistry discipline breaks down its SLOs into three categories. For the purpose of this report, two examples for each category are given.

1. Skills in Quantitative Problem Solving: the student will demonstrate the ability to follow a logical process based on well-established scientific principles and demonstrate the ability to use the appropriate problem-solving techniques to solve a scientific problem.
    a. Chem 11 and Chem 12: students must score at least 70% on the nationally-normed American Chemical Society exam for first- or second-semester General Chemistry.
    b. Chem 19: students should be able to predict the products of a reaction between an acid and an amide or calculate the concentration of a dissolved solute in a solution.

2. Mastery of Experimental and Scientific Communication Skills: When conducting a laboratory experiment, the student will follow written procedures commonly used in the chemistry laboratory accurately and safely. When completing a lab report, the student will apply the scientific method correctly by being able to state a hypothesis, take careful measurements, estimate uncertainties and draw appropriate conclusions based on gathered data and scientific principles.

    a. Chem 10: students must be able to perform specific measurements and procedures described in the Acid-Base Titration experiment.
    b. Chem 21: students will follow written procedures to carry out common organic chemistry experimental techniques including reflux, distillation, extraction, recrystallization, and melting-point determination.

3. Skills in Relating Theory to Observations: The student will be able to relate microscopic theories to macroscopic observations specifically using the chemical principles developed in the course.
    a. Chem 9: students will be able to analyze the chemical groups in drugs and poisons found in today's marketplace.
    b. Chem 22: students will write a reaction mechanism consistent with observation or determine a compound as aromatic, non-aromatic, or anti-aromatic by evaluating its structure and/or bonding.

Physics and Engineering Disciplines
In Physics and Engineering courses, SLOs are used to assess two important skills. They are listed below along with some representative examples from specific courses:

1. The theoretical capabilities of the student to be able to solve complex problems in idealized situations.
    a. Physics 6: students will be able to use Newton's Law to explain a problem of two masses connected via a string passing over a pulley.
    b. Physics 22: students will use Maxwell's equations to explain the creation of an electric current by a changing magnetic field.

2. The experimental capabilities of students in making measurements and being able to explain consistencies and/or anomalies in the observed data using error analysis and/or arguments regarding the theoretical underpinnings of the experimental setup.
    a. Engineering 11: student will be able to create a design using the Solidworks software.
    b. Physics 23: student will show consistent ability to perform error analysis and experimental design in their lab notes.

2. Describe when and how the program assesses these SLOs and uses the results for program improvement including:
- How outcomes are assessed and how often
- How and when the program or discipline reviews the results and engages faculty in the process

Physical Sciences Department
The SLO categories listed in section C.1. came about after extensive discussions that took place among faculty members around ten years ago. There was general agreement on what skills are

needed to be a competent scientist and these skills were then translated into the respective SLOs.

Currently, instructors not only inform students about the importance of mastering these skills by listing them in their classes' syllabi, but also infuse the course with repeated examples of applications of these skills. For example, in almost every chemistry or physics class meeting, instructors and students will perform some type of quantitative problem solving. Similarly, every laboratory meeting highlights a specific experimental skill that students should practice on. As a result, students are aware that they will need to master these outcomes to be successful in the course.

All instructors teaching the same course must use the same SLO assessment tool. The program leader informs all the faculty members in the program what the assessment tools are, and how to use them to measure each SLO. At the end of each semester, each faculty must report their SLO results back to the program leader. Two specific examples are given below to illustrate the process of SLO assessment, analysis and program improvement.

In General Chemistry the tool used to assess the first SLO, i.e. Quantitative Problem Solving Skills, is a nationally-normed multiple choice exam published by the American Chemical Society (ACS). The faculty members in the General Chemistry program met in 2015 to discuss what an appropriate cutoff score is for a student to be considered as "passing the SLO". The program leader then informs all faculty members teaching General Chemistry of the cutoff score, 70% in this case. Each faculty member must administer the ACS exam to their students and report their SLO percentages back to the program leader after the semester ends. In addition, each instructor is also required to indicate whether his/her students pass the SLO in the mProfessor web portal. In the following semester, faculty members meet two to three times to discuss the SLO results and specific changes that need to be introduced following the SLO analysis. The most recent discussion in Fall 2019 resulted in an agreement to implement the use of the Zipgrade app in grading ACS exams to get a much more detailed sense of student performance on a question-by-question level.

Organic Chemistry faculty members evaluate the third SLO, Skills in Relating Theory to Observation, by using questions related to a chemical reaction mechanism. The questions used for the evaluation can be free response (e.g. write a mechanism or a synthesis) or multiple-choice. When multiple-choice is used, the evaluation is based on several questions. The program leader creates a document on assessing and reporting SLOs to maintain consistency in the process. The results for a given semester are discussed in a meeting held near the beginning of the following semester. Faculty members who taught the relevant courses during the last term, other faculty who commonly teach those courses, and the department chair attended these SLO meetings. Each faculty member prepares a spreadsheet that includes the results (pass/not pass) for each SLO, the final exam percent score, the percent score on the test that included the questions used to evaluate the SLO, and the student's overall letter grade. Often the specific questions used in the assessment are included. Faculty members assess SLO results, compare results to past semesters, discuss how to improve results, compare methods of instruction and testing, and brainstorm methods to make lab work more fulfilling for students.

The effectiveness of SLO analysis as a tool for program improvement is very dependent on the number of full-time (FT) faculty in the program. For example, the Organic and Biological Chemistry program faculty members are nearly all FT and as a result, this program's faculty take the most time to create, administer, assess, and discuss their SLOs. Many fruitful discussion and approaches have resulted from this in-depth engagement with the SLO analysis process.

In contrast, for most of the last six years Chem 10, which is the course with the largest enrollment in the department, has either one or two FT faculty members along with on average twelve adjunct faculty. Due to the need to commute to various colleges, most of the adjunct faculty understandably do not have time to contribute much to the SLO discussion. This leaves an overwhelming amount of work for the FT faculty involved. As a result, SLO analysis for Chem 10 has not yielded much actionable result despite efforts by the FT faculty members to encourage PT faculty involvement, for example by using Zoom as a way to participate virtually in program meetings. Starting in Fall 2019, the department chair decided to take a more active role by teaching Chem 10 during every Fall and Spring semesters. The department is also hiring a new FT faculty to start in Fall 2020 who will be focused on both Chem 10 and Chem 19. We hope that these new additions will bring much needed energy to help rejuvenate the program.

Similarly, we see how new FT hires in Physics and Engineering also spur many of the recent updates to the program, including in SLO discussions. We will note these changes in section D.

3. If your program or discipline issues a degree or certificate, list each degree or certificate and the core competencies that students are expected to achieve on completion.

Core competencies focus on the body of knowledge, attitudes, and behaviors a student will have acquired upon completion of a program or certificate and are assessed by either a capstone course or success rates on SLOs for core courses.

In Spring 2019, the department received approval from the Chancellor's office to award the following degree and certificates in Engineering:

- Associate of Science Degree and Certificate of Achievement in Engineering
- Certificate of Achievement in Introduction to Engineering

Both certificates and degree have the same program-level learning outcome, that is upon completion of the program, students will demonstrate basic knowledge of engineering principles of design and analysis, and exhibit effective communication skills and ethical behavior as shown through their written work, teamwork, and lab work.

Students who receive these awards should have acquired the following core competencies:

1. Self-Discipline

2. Academic Honesty
3. Teamwork and Interpersonal Skills
4. Self-Confidence
5. Critical Thinking
6. Quantitative Reasoning
7. Content Knowledge
8. Technological Literacy
9. Information Literacy
10. Oral and Written Communicate Skills

4. What other evaluation measures does your program or discipline use to inform planning? (For example, student surveys, enrollment trends, student success, retention, degrees/certificates awarded, job placement, transfer rates, TIMS report, tutor usage, etc.). Note trends and differences in performance by group (ethnicity, gender, age) or enrollment type (day/evening, on-ground/on-line)

Physical Sciences Department

The department uses a combination of other tools to inform planning as follows:

1. Analysis of enrollment trends in ISIS for each course including class cancellation, number of students per sections, and other related measures.
2. Surveys of student to measure interest in a class or other factors.
3. Analysis of student success rates through the Tableau Dashboard and additional course-specific data request from IR.

The use of these additional measures is discussed below for each of the programs.

Introductory Chemistry Program

In 2018, since IR data showed an overall decrease in the F-1 student population at SMC, efforts were undertaken to increase the number of domestic students in Chem 9. One of these measures is to add Chem 9 to the list of classes that can fulfil the science requirement for students who plan to transfer as Psychology majors. The change to the requirement took place in Spring 2019 and some Chem 9 instructors noted an increase in Psychology majors in their Chem 9 classes in Fall 2019.

In 2015, Chem 10 FT faculty analyzed the grade distribution of FT and PT instructors teaching the course and noticed the discrepancy in curriculum content taught by FT versus some adjunct faculty. At the same time, Fall 2016 saw the introduction of Chem 19 which helped to separate some of the Chem 10 students who were interested in Nursing and other Allied-Health careers. Both of these events provided the impetus for Chem 10 faculty to create a new Chem 10 Faculty Handbook to be distributed to existing and new Chem 10 instructors. A number of curricular changes were introduced to increase the rigor of Chem 10 so that it may better prepare students for Chem 11.

Instructors who had taught Chem 10 for a long time uniformly agree that a clear equity gap exists between Latinx and African American population compared to White. Since Chem 10 is the gateway STEM course, not just for chemistry, but also for Life Sciences, Engineering, and other STEM fields, it is critical that the equity gap be closed. As part of this effort, the department started a Chem 10 Bootcamp program in Spring 2015 to provide concurrent help to students during the semester (Fall or Spring) that they are enrolled in Chem 10. A number of Chem 10 instructors take on the task of teaching Bootcamp sessions that meet either once or twice a week. Funding was provided by the first and second phase of the STEM Grant. In addition, a bridge Bootcamp was also attempted for two intersessions during Winter and Summer sessions, but did not continue due to lack of funding and personnel.

General Chemistry Program

IR data show that students who have passed Math 20 prior to enrolling in Chem 11 have an 83% success rate and there is a general correlation between math level and success rate. Similar analysis shows that students that entered into Chem 11 after passing Chem 10 have a 65.3% success rate, those entering via the challenge exam have a 78.1% success rate, and those entering by waiver have a 50.3% success rate. These numbers argue for a stricter enforcement of the Chem 10 prerequisite.

As we noted in the previous program review, there is a downward shift in grades when comparing Chem 10 to Chem 11. An A student in Chem 10 tends to get a B in Chem 11 and so on. The same trend occurs in Chem 11 to 12, although less pronounced. There could be two reasons for this:

1. The Chem 10 curriculum was too broad and did not prepare students well for Chem 11. Since the introduction of Chem 19 in Fall 2016, the Chem 10 faculty has revamped its curriculum resulting in a more rigorous class (see discussion above).
2. It takes students a few semesters to learn how to study for chemistry classes. Faculty members who teach multiple courses ranging from Chem 10 to Organic Chemistry typically see the improvement in “academic maturity” of students. This is reflected also in a smaller gap of grades between the higher level chemistry classes.

Grade distributions as a whole have shifted. For Chem 11, the number of A’s has shifted from 16% to 21% in the six year period. In turn, for Chem 12, the number of A’s shifted from 23% to 18% in the same period. It is possible that the program needs to revisit our grading standards to ensure that students passing Chem 11 are truly prepared to succeed in Chem 12.

Both the Latinx and African American population in General Chemistry experience a significant equity gap for both retention and success as shown in Table 13.

Table 13

Equity Gap in General Chemistry

	Chem 11	Chem 12
Latinx Retention Gap	-9%	-10%
African American Retention Gap	-10%	NA[a]
Latinx Success Gap	-15%	-16%
African American Success Gap	-15%	NA[a]

Note: The retention and success percentage of the White population is used as the benchmark.
[a] The African American population data are difficult to analyze due to its relatively small number. As a result, individual student characteristics may impact the data more than expected. We see positive and negative gaps in the data which does not give a clear trend.

The Chem 11/12 program is planning to address the equity gap by refocusing in-class time to incorporate more student-centered activities. The program faculty has updated the course outlines of record so that approximately 1.5 hours per week in lecture and 1 hour per week in lab will be devoted to activities that allow students to work through problems on their own with the support of their instructor. Students that succeed in Chem 11/12 have already learned that problem solving practice is fundamental to their success. However, students that struggle to succeed often do not commit the time outside of class for problem solving practice. By incorporating more problem solving into the coursework, we hope to show students the value of problem-solving practice and encourage them to continue the practice at home.

Organic and Biological Chemistry

In addition to the various planning methods described for the department, Chem 19 also uses data from the US Bureau of Labor Statistics. The data predict an increasing need for nurses, respiratory therapists, and other allied-health professionals who all need to take Chem 19.

Slightly less than 50% of Chem 19 students pass the course with an A, B, or C (data not shown). If we break the numbers further down, we see that Basic Skills students, who make up about a quarter of Chem 19 students, have a 33% success rate, while non-Basic Skills students succeed at a 58% rate. The relatively low success rates of students in Chem 19 is also observed in other pre-Allied Health courses such as Anatomy and Math (data not shown). There is clearly a need to provide a more formalized help specific to this group of students which may include financial aid as well as small group supplemental instructions or tutoring.

In Fall 2019, the department asked IR to administer a survey to gauge the type of tutoring that the department should offer for Chem 19 students. One result of this survey is the establishment of Chem 19-specific tutors at the Science Learning Resource Center effective Spring 2020.

Enrollments of other courses in this program are closely monitored by the program faculty to better serve the student population. Some examples of these are described below:

1. The gradual decrease in the enrollment numbers for Chem 31 has resulted in fewer sections being offered annually. At this point, we only offer one section in Spring every year. In Spring 2017, students were surveyed (n = 110) about the feasibility of offering Chem 31 as lecture-only or with the lecture and lab split. There was no clear direction given by the survey, so for the immediate future, we plan to offer one section of the course in the spring semesters and continue to monitor enrollment and student interest.
2. There seems to be correlation between enrollment during the regular semester of the Organic Chemistry courses with whether they are offered during the intersession. This has led to offering Chem 21 only during Fall and Spring, while Chem 22 started to be offered during Winter and Summer to help increase the enrollment of Chem 24 in Spring and Fall, respectively.
3. Night sections of Organic Chemistry have been offered for each year covering this review period. With the impending retirement of the full-time faculty who teaches these sections, the department must review how to meet the needs of these students, who typically work during the day. We are currently planning not to offer any night section of organic chemistry in the 2020-2021 year. Student response and enrollment information will help guide us on what to do in future years.
4. Two additional sections of Chem 19 were added in Spring 2017 based on demand seen in Fall 2016. Both new sections filled without decreasing enrollment for Chem 10. Similarly Spring 2020 sees two sections added with fill rates north of 90% over all Chem 19 sections.

Conceptual Physics Program
Physics 14 students whose educational goal are undecided have drastically lower retention and success rates compared to the rest of Physics 14 students. A possible reason is that committing to a six-hour per week science course when it is not your major is much easier to do if you know it is explicitly needed for you to reach your goals. We are hopeful that the project to redesign the SMC student experience that the College is undertaking will provide a better idea to future students on the need to take Physics 14. We did not see the same correlation between educational goal and success rate in Physics 12, possibly because Physics 12 requires only three hours a week, while Physics 14 requires six hours.

General Physics Program
We see a clear equity gap when comparing the Latinx (-13%) and African American (-23%) students to White in Physics 6 and 7. The data improve slightly when we removed students who dropped the class so the gap is now -8% for Latinx and -20% for African American students. We also have data that show that proficiency in math is a requirement for success in Physics 6 and 7. One possible explanation for the equity gap then is that the Latinx and African American students in these courses may not have as strong a math background as their White and Asian P/I counterparts.

Even though Physics 6 requires Math 2 (or 3 and 4 now) completion, because this prerequisite is not computer-enforced, we commonly see students with lower math levels enroll in General Physics. In fact, IR data shows that the four math courses that provide the largest input of students to Physics 6 are Math 54 to Math 7. When we analyzed the relative percentage of Latinx and African American students in these math courses, we see that larger numbers of Latinx and African American students are found in the lower math levels, Math 54 and 20 compared to the higher levels, Math 2 and 7 (Table 14). Thus, we hypothesize that the Latinx and African American students in Physics 6 and 7 may also have weaker math background, resulting in the equity gap that we observed.

Table 14

Relative Percentage of Ethnic Groups in Math Courses from 2013-14 to 2018-19

	Math 54	Math 20	Math 2	Math 7
Asian P/I	16%	13%	26%	31%
Latinx	42%	51%	32%	25%
African American	7%	7%	4%	4%
White	25%	20%	23%	23%

A possible way to decrease the equity gap may be a course similar to Physics 20 for those planning to take Physics 6, namely a preparatory course focusing in application of math in physics.

The major trend in Physics 8 and 9 is that the number of students taking Physics 9 is much lower when compared to the number of students who successfully passed Physics 8. Enrollment in Physics 9 is only 29% (204 out of 705) of the number of students in Physics 8. This is despite the fact that the passing rate for Physics 8 is slightly higher than 65% (458 students). Since these courses were originally meant for pre-medical students, it is possible that the decrease has to do with the relaxing of Physics requirement for medical school applicants, as discussed in section B.1. Another possibility is that more students may be taking the second course at their transfer institutions. We had heard both of these reasons mentioned by SMC counselors and students, although we do not have hard data to back these up.

In Fall 2019, by request of the department, IR had sent a survey to Physics 8 students to gauge their interest in taking Physics 9. The result of this survey will be used to plan for the number of Physics 9 sections that the department will offer in Fall 2020.

Physics for Engineers Program

As noted in section B.1., the department experienced a growth in enrollment while the College saw a decrease in the past six years. One of the strongest growth areas has been the Physics for Engineers sequence. Much of the reason for this growth is the focus on increasing the number of Engineering majors in the second phase of the HSI STEM grant. In addition, the overall statewide promotion of STEM majors also likely plays a role.

One of the recommendations from our last program review's Executive Summary is to develop a preparatory course for the Physics for Engineers sequence. We had recently started to offer such a course titled Physics 20, which we hope will improve retention and success, particularly among first-generation students, as well as students in other underrepresented groups. For example, Latinx students consistently show between a 10% to 20% equity gap compared to White in their retention percentage in classes such as Physics 21 and 22. Although the results from Physics 20 are too early to tell, we are hopeful that the class is accomplishing its objective of helping to reduce this equity gap.

Engineering

SMC's Engineering program is still relatively new, with most classes only offered within the last three years. Over the course of the last three years however, the percentage of students enrolled in engineering classes has increased, despite the downward trend observed for the College. During this time, apart from the hiring of a FT professor, the department also hired three new PT professors to satisfy course demand from students. We encourage the College to consider ways to support this very vibrant program in future years to sustain its growth and development.

Due to relatively low numbers of students, it is perhaps less meaningful to view retention rates per class in the Engineering program. If we combine retention rate over all Engineering courses, we see that this is at 80%. Because many of the Engineering courses are new and there are often only one section of each, it would not be statistically meaningful to break this data any further. We hope to provide a much more productive discussion in future Program Reviews as this program keeps growing and reliable trends can be observed.

D. Program Improvement

D.1. Looking Back

1. Note the status of the previous year's objectives

List of Objectives for 2019-2020

a. Further explore a potential self-placement regime for Chem 11.

Status: On Hold

Comments:

The department had proactively anticipated the possible impact of AB-705 in our courses, particularly Chem 10 and Chem 11. One concern is that the department may be prohibited from requiring students to take Chem 10 before Chem 11. A second concern is that the current Chem 10 Challenge Exam, which is used to determine a student's content preparation for Chem 11, may no longer be a valid instrument as it may have disproportionately impacted Latinx and

African American students. In fact, currently the Challenge Exam is combined with a multiple measure tool e.g. a student's high school GPA as a way to determine appropriate placement into Chem 11.

In the past year-and-a-half, we had several department meetings devoted to finding ways to inform students about their own level of preparedness for Chem 11, should they decide to skip Chem 10. We examined a past placement exam used in the department which contains both math and chemistry knowledge. We think that this exam can be used to inform students of the level of content mastery we expect from a student taking Chem 11.

In our 2018-19 annual program review, it was noted that science departments may not be required to comply with AB 705 based on a workshop conducted by the statewide Academic Senate. In Fall 2019, we had consulted the Vice President of Academic Affairs and she indicated categorically that AB 705 will not impact other disciplines except for Math, English, and ESL. As a result, we have decided to take a wait-and-see attitude on this objective.

b. Review chemistry lab safety and lab cleanliness guidelines.

Status: In Progress

Comments:
The Organic and Biological Chemistry group took a lead in this by posting instructions on how to clean work and equipment areas in the laboratory room that they use, Science 305. Starting Fall 2019, the entire chemistry discipline followed the lead. Currently, a sheet listing all the areas that need to be inspected and cleaned is taped on the instructor bench in each chemistry laboratory. In addition, a list showing the names of all faculty members who are using the room along with their class time and day is also provided on a clipboard. The department chair asks each faculty to indicate on the list whether the room is clean or not upon entry and exit. If the room is not clean, the faculty member should write down the areas that need to be cleaned. We have seen improvements in general cleanliness as everyone is more aware of who comes before and after them in the lab. The department chair continues to encourage the use of this instrument at the start of and during the semester.

At the end of Fall 2019, the department chair, the lead laboratory technician for chemistry, and the Assistant Director of Safety and Risk Management did a walkthrough of all the chemistry lab rooms including the chemistry stockroom. From this inspection, the technician compiled a list of issues which are currently being addressed. For problems that the department can fix, e.g. the lack of first-aid and chemical spill kits, they were taken care of by Winter 2020. For problems that require the action of other departments, e.g. certification of safety eyewash stations and showers, which must be done by SMC Facilities, Mr. Daniel Phillips will follow up and update the department chair and staff monthly. We plan to perform this safety inspection annually to make sure we comply with relevant safety regulations.

2. List accomplishments, achievements, activities, initiatives undertaken, and any other positives the program wishes to note and document

In the past six years, our department has a number of notable achievements which are listed below:

- Creation of Chem 19 to address the needs of pre-Nursing and pre-Allied Health students. Further details are provided in section D.1.3.
- Creation of Physics 20 to improve the success rates of students entering calculus-based Physics courses, Physics 8 and 21. Further details are provided in section D.1.3.
- Hiring of a new Engineering FT faculty who not only developed four new Engineering courses, but also established many of the physical resources needed for an effective Engineering program. Further details are provided in section D.1.3.
- Creation of the Chem 10 Bootcamp Program which helped to close the equity gap for African-American and Latinx students in an introductory general chemistry class. The Chem 10 Bootcamp program won the statewide Dr. John W. Rice Diversity and Equity Award in 2016.
- In collaboration with Mr. Daniel Phillips, the department implemented various processes to increase the safety of chemistry laboratories including starting an annual safety inspection process, removing old hazardous chemical wastes and other measures discussed in section D.1.3.
- In the past five years, the Chemistry Club which is supervised by two of our faculty members, Professors Jennifer Hsieh and Travis Pecorelli, had won multiple national award categories from the American Chemical Society including the Green Chemistry Award, Commendable Student Club, and the prestigious Outstanding Student Club. Of note, even the UCLA Chemistry Club never won this last award.
- A number of General Chemistry faculty members incorporated the use of OpenStax Chemistry, an Open Educational Resource (OER) material that helps reduce the cost of textbooks to students.
- The General Chemistry program continues to use the nationally-normed American Chemical Society exam to measure the performance of SMC students and maintain rigor of the program.
- The Organic Chemistry program designed three solo labs which require students to perform experimental analysis on their own. Student reaction has been positive with many students noting that they like being responsible for their own lab work, it has helped their confidence in lab, and that it helps to prepare them for the capstone qualitative analysis labs.
- In collaboration with the Life Sciences department, we set up a food pantry for students in the Science building.
- The department now uses an online-based reporting form for issues related to the Science building. Each submission of the form is automatically emailed to the department chair and administrative assistant. This system allows for better follow up of relevant issues with the appropriate departments on campus, whether they be the

Maintenance, Custodial, or Grounds department. We have seen an improvement in the speed at which these issues are addressed following the use of this form.

- Several of our faculty members won the Teacher Excellence Award from Alpha Gamma Sigma including Lani Bautista, Arno Papazyan, Michelle Scholefield, and Sehat Nauli.
- Since the last review, we had hired a number of new faculty members. All of these hires were replacements for FT faculty lost to retirement or resignation. In physics, the hiring has kept pace with attrition so our faculty has maintained its size, but in chemistry, we still need one more hire to keep pace. We look forward to a new FT chemist joining us in Fall 2020. Below are brief biological sketches of five of our most recent hires.
    - Tram Dang came from San Diego. She did her undergraduate work in Physics and Biophysics at UCSD followed with graduate work also at UCSD on Materials Science and Engineering. She joined SMC in Fall 2015.
    - Timothy Dong came from the San Gabriel Valley. He earned his B.S. degree in Chemistry from the California Institute of Technology in 2006 and then his Ph.D. from UCLA in 2012. His Ph.D. thesis was on the "Synthesis and Biological Testing of Glycosylated Fluoroquinolone Antibiotics". He joined SMC as a full-time faculty member in 2015. Prior to that, Tim taught chemistry at the Claremont Colleges for one year and Pepperdine University for two years.
    - Travis Pecorelli came from Bellflower, California and went to earn his B.S. at UCI and his Ph.D. at UCLA, both in Chemistry. His dissertation was titled *Multiple Methods of Activation of Molecular Machines on Mesoporous Silica Nanoparticles.* He joined SMC as a part-time faculty in Fall 2013 and became a full-time faculty in Fall 2015.
    - Forouzan Faridian earned her BS from UCLA and MS from CSUN in Physics. Her Physics teaching experience spans various high schools in the Los Angeles area, SMC, El Camino College, CSU Dominguez Hills and Loyola Marymount University. She also cofounded and served on the board of the Westchester/Playa Education Foundation. She became a full-time SMC faculty in 2017.
    - Kyle Strohmaier was born in Hayward, CA. He earned his B.S. in Physics and Applied Mathematics and B.A. in German from UC Riverside and his M.S. in Physics from the University of North Carolina at Chapel Hill. After conducting experimental plasma physics research at UCLA, he started teaching physics part time at El Camino College and SMC. He worked part time at SMC for 3 years before joining SMC's faculty full-time in Fall 2019.

3. Summarize how the program or service area addressed the recommendations for program strengthening from the executive summary of the previous six-year program review

Below are the five recommendations from our last six-year review and the department's responses to them.

1. *To improve success rates consider development of a preparatory course for students planning to enter calculus-based Physics courses.*

The department created a new course, Physics 20, which is meant to prepare students to better succeed in calculus-based Physics, Physics 8 and Physics 21. Based on surveys of instructors and students as well as a review of similar courses offered by twenty colleges and universities in the area, the department designed a course with the following goals:

- To improve students' study skills. The course teaches students about various learning styles, being proactive in class, and how to study from a Physics textbook.
- To strengthen students' basic math skills. The course reviews basic Algebra, Geometry, Trigonometry, Calculus, and Error Analysis. In addition, students are also taught how to decipher word problems in Physics.
- To introduce the topic of Mechanics of solids such as Kinematics, 1- and 2-dimensional motion, Dynamics, Momentum, and Energy.

The class was first offered in Spring 2019 with funding from the HSI STEM grant. Enrollment was very low in the first two semesters, but has since stabilized to the mid teens. Advertisement from the SRI program and other Physics faculty have been critical in promoting the class to students.

Currently, Physics 20 is offered as a 12-week course in the Fall and Spring semesters as well as during intersessions. During the intersession, it serves as a course to take prior to taking Physics 8 or Physics 21 in the following regular semester. During the regular semester, Physics 20 serves to help students who fail early on in their Physics 8 or Physics 21 class and need help before they retake the course.

One concern that the faculty have is that starting the class at week five maybe too early because students enrolled in Physics 8 or Physics 21 may not have their first examination yet. Consequently, we plan to convert Physics 20 to an 8-week course in the future. We have also discussed the possibility of creating an online version of Physics 8.

We also need to collect enrollment data for Physics 20 and correlating this to success rate in Physics 8 and Physics 21. Of particular importance is comparing the success rate of students who have taken Physics 20 versus those who have not.

2. *To better address the preparatory needs of allied health students consider development of a General Chemistry, Organic Chemistry and Biochemistry course.*

We created Chem 19, a General, Organic, and Biochemistry course to specifically meet the needs of our pre-Nursing and pre-Allied Health students. The course was first offered in Fall 2016 and for the first two years, only offered during the regular semesters. Beginning 2019, we started to offer the course during intersessions as well. All Chem 19 sections typically fill relatively quickly, indicating that an important student niche group has been identified and is being served by this course. It is likely that the course will experience moderate growth in the next six years.

Informal conversations with both instructors of physiology and microbiology indicate that students who pass Chem 19 are well prepared for these more advanced courses. These instructors have recommended that the department emphasizes to students to take Chem 19 instead of Chem 10 if they plan to enroll in these life science advanced courses.

We are still concerned about the relatively low success rate of students in Chem 19. In the future, we plan to provide more formalized help specific to students in the pre-Allied Health track, which may include financial aid as well as extra one-on-one or small group instruction. These support services are highlighted in section G.

3. *Implement planned strategies to improve success rates in Physics courses.*

In the last review, we had indicated a desire to increase the weekly contact hours in Physics 8 and 9 to allow faculty sufficient time to cover the mandatory topics in those courses. It was believed that the "rushed" nature of the content delivery might have resulted in a lower overall success rate. Unfortunately, a couple of things happened that delayed this objective. First, the department chair who started this project was promoted to Dean of Instructional Services. Secondly, the faculty who initially spearheaded this project decided not to press on with it and he recently retired. Conversations started in Fall 2019 about the need to pursue this project, but it does not seem high on anyone's priority as the success rates in the two courses are not anomalously low compared to other Physics courses.

A second project described in the last program review is to develop strategies to narrow the variations in grading standards across sections of each course. In the past six years, Physics faculty members had had many discussions as well as sharing of exams and questions during their regular program meetings. These conversations had organically led to a norming of grading policies among the physicists.

Lastly, a major part of improving Physics success rates is the creation of Physics 20, which is described in detail in an earlier section.

4. *Ensure Standard Operating Procedures are in place for the use of all hazardous materials in Physical Science labs.*

A number of the department's Chemistry faculty contributed significant time to develop Standard Operating Procedures (SOPs) for the laboratory chemicals that the department uses. However, after spending months working on the SOP for just one of those chemicals, the department decided that this task should not be part of the faculty members' responsibilities. Our chemistry faculty members do not have the content knowledge that extends to knowing what the legal requirements are for the use of various laboratory chemicals.

At the beginning of 2019, the College hired Daniel Phillips as the Assistant Director of Safety and Risk Management. This was a recommendation that the department made in our last six-year Program Review and we are delighted that it has finally taken place. In the one year that Mr. Phillips has been in his position, he along with the department's faculty and staff have worked to develop an annual chemical inspection procedure, a process to remove unused chemicals from the chemical storage area, and a systematic method of labeling chemicals placed in secondary containers during student labs. We had also discussed the need to update the College's Chemical Hygiene Plan and to identify areas where SOPs are required. We foresee the development of SOPs as the next project that he and the department will tackle together.

5. *Investigate opportunities to expand support to Engineering majors.*

Since the last six-year review, we had made numerous changes to the Engineering program. We hired a FT faculty and three new PT faculty. We created four additional courses, Engineering 1, 11, 21, and 22, to increase the diversity of offering and satisfy student demand. The description of these courses are given in section A.1. Correspondingly, enrollment has more than doubled (121%) in the past six years. In addition, the department also created one AS degree and two Certificates of Achievement in Engineering.

The HSI-STEM grant has played a critical role in supporting the growth of the Engineering program. The grant helped fund various equipment purchases including new 30 Dell PCs optimized for use with graphics-intensive programs, specifically for SOLIDWORKS, a 3D Computer-Aided Design (CAD) program and tools such as 3D printers and a table saw. Furthermore, the grant also paid for the renovation of room 305 in Drescher Hall (DH) to serve as the new engineering computer laboratory space. A combination of grant and district funds are used to plan and build the new engineering workspace to be located in DH109. As of November 2019, the SMC Board or Trustees had accepted a bid submitted by a contractor for this project.

The Engineering Program at SMC also maintains a continuing collaboration with UCLA in the form of two grants. The first grant is from the Office of Naval Research, which supported UCLA's efforts to bring hands-on engineering activities to its community college partners. Through this grant, the student chapters of professional engineering societies at UCLA are sharing their projects to SMC's Engineering Club. About $30,000 worth of equipment will be purchased by UCLA on behalf of SMC, which will include 10 laptops to start an engineering laptop lending program.

In addition, SMC Engineering is partnered with UCLA and other community colleges for a grant provided by the Teagle Foundation. This grant serves to infuse liberal arts studies into engineering coursework and provide advanced engineering students an opportunity to create and lead a hands-on project for SMC's Engineering 1 course.

4. Describe any changes or activities your program or service area has made that are not addressed in the objectives. Identify the factors (e.g. licensure requirements, state or federal requirements, CCCO mandates, regulations, etc.) that triggered the changes, and indicate the expected or anticipated outcomes.

Our 2018-19 annual program review mentioned the need to re-establish consistent operating procedures in the chemistry stockroom. Due to frequent understaffing between 2014-2016 and lack of adequate training of new stockroom technicians, several problems in the 2017-2019 period occurred including:

- Errors in preparation of chemical reagents used by students in the laboratory.
- Insufficient supervision of student workers.

These and other safety-related problems led to tension between the chemistry stockroom staff and faculty members which resulted in frustration on both sides. In Summer 2019, the department chair and the technicians' supervisor met with them to discuss these specific issues and clarified their responsibilities. In addition, the department has implemented an online reporting system so faculty members can easily share problems occurring in the chemistry lab. These error reports are automatically sent to the stockroom staff and the department chair. Once they receive the report, the stockroom staff responds by fixing the problem so it does not reappear in the next lab period. In addition, the department chair now meets monthly with the chemistry stockroom staff to discuss these reports and ways to fix these errors more permanently. As a result of these changes, we have seen an overall improvement in the chemistry stockroom operation and the relationship of the stockroom staff and faculty.

5. If your program received one-time funding of any kind, indicate the source, how the funds were spent, and the impact on the program (benefits and challenges).

As discussed in prior sections of this document, the HSI STEM grants has supported the department in various ways. The reader is encouraged to read sections A.4., C.4., and D.3.3. for more detailed descriptions.

In addition, a number of faculty members were awarded the Margin of Excellence grants from the SMC Foundation. Over the past six years, these grants have enabled the purchase of:

- Four portable document cameras that record written materials and convert them to PDF files.
- Laptop and other materials used to incorporate active learning strategies in general chemistry classrooms.
- Supplies to perform western blot and other biochemical techniques in Chem 31.
- Various supplies for Engineering courses

Muriel Walker-Waugh, Jamey Anderson, the Life Sciences department, SRI, the Black Collegians and the Adelante programs were jointly awarded a $15,000 President's Circle Award for Innovation from the Santa Monica College Foundation. The funds were used to set up the Forum on Cultural Diversity in the Sciences which was a series of luncheons where faculty and students came together to listen to an invited speaker and share information about how to succeed in the science fields.

Tram Dang was awarded the Chair of Excellence award from the SMC Foundation for her proposal to create the Engineering maker space in Drescher Hall.

6. Describe departmental efforts to improve the teaching and learning environment.

The Physical Science department makes effective use of SMC's peer evaluation process to provide all faculty with ongoing feedback and opportunities for discussion of methods for the improvement of teaching and learning. Evaluations are thorough and efforts are ongoing to maintain a culture of peer support in the implementation of teaching methodologies.

We are aware that a significant equity gap exists in the physical sciences courses between Latinx and African American students compared to their White counterparts. The following are some of the efforts our faculty had made to help close this gap:

1. Several faculty members participated in the Teaching Men of Color in the Community Colleges Certification program in Summer 2016. This workshop was taught by Professor Frank Harris from San Diego State University, who is well-known for his research into promising strategies and practices that support the learning experience of students of color, particularly men.
2. The Physical and Life Sciences departments held two joint meetings where Sherri Bradford, the faculty leader of the SMC Black Collegians program, presented topics related to closing the equity gap. We discussed how to write faculty job announcements that will be more welcoming to underrepresented candidates and other best practices.
3. As a result of the discussions above, our 2019-2020 FT faculty hiring committees in Physics and Chemistry have emphasized the importance of finding candidates who can help close the equity gap. This resulted in a major change in the way we wrote our our job bulletin. Our first two preferred qualifications now require candidates to have experience in equity-minded practices. Secondly, we posted these job bulletins at scientific organizations whose members are from underrepresented groups, for example the Society for Advancement of Chicanos/Hispanics & Native Americans in Science and the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers. Lastly, the department chair personally reached out to heads of Physics and Chemistry departments in sixteen Historically Black Colleges and Universities (HBCUs) to advertise these FT faculty openings. We hope to be able to increase the diversity of our faculty ranking with these efforts.

In 2015 with efforts from Muriel Walker-Waugh and Jamey Anderson in our department, the Life Sciences department, the SRI Program, and the Black College/Adelante programs, we launched the Cultural Diversity in the Sciences luncheon series. This series asked students, specifically those from underrepresented backgrounds to attend lunches with faculty members in order to increase student familiarity with instructors with the hope that it will lead to increased interactions in and out of class. The inaugural speaker for this lunch was Professor Carlos Gutierrez who is the Director of the Minority Access to Research Careers and Minority

Biomedical Research Support programs at CSULA. The luncheon was attended by a number of faculty members in both the Physical and Life Sciences departments.

Several faculty members participated in the annual Faculty Summer Institute which helped them learn pedagogical techniques particularly those important in closing the equity gap. In addition, Forouzan Faridian also attended the UCLA Faculty Learning Program in 2018, a year-long training aimed at improving student achievement in STEM undergraduate courses in 2- and 4-year institutions. This program is run by the UCLA Center for Education, Innovation and Learning in the Sciences with the goal of helping faculty apply education research on scientific teaching. Faculty who participated in these training programs shared their experiences to the rest of the department at program meetings, during formal evaluations, and during informal conversations in the hallway.

A number of faculty use a class response system such as iClicker, Socrative, Kahoot, or others to engage students and gauge their understanding of the concept taught in class. Similar tools are also used in the Chem 10 Bootcamp to help increase student engagement. In Fall 2019, the Chem 10 Bootcamp also implemented a live stream version of the workshop session, so students who cannot come to the on-campus session can still participate through Canvas from remote locations.

Independent study courses are offered by several different faculty within the physical science program to provide students with an introduction to scientific research, including hands-on use of the FT-NMR instrument, participation in the IITA collaborative project, and building and improvement of a hydrogen fuel cell. Students taking the independent studies courses in conjunction with an organic lab course are able to integrate the information learned in the classroom directly with real projects, and all independent study students learn to solve the concrete issues encountered when trying to get research results from scientific instrumentation. They are also able to extend many of their skills to the equivalent of an upper division or graduate level, helping them prepare for a smooth entry into research laboratories outside of SMC.

Several experiments were tested, refined and now make up the collection of new laboratory experiments in Chem 9, Chem 11, Chem 12, and Chem 24. Collectively, these new experiments increase the breadth and depth of the practical experience that SMC chemistry students gain in these respective classes.

7. If there a tutoring component or other learning support service associated with the program, describe the relationship between the service(s) and the instructional program. If applicable, discuss any data you have compiled regarding student participation and the impact on students success.

The Science Learning Resource Center (LRC), located in Science 245, is staffed by Paulo Taboada (Tutoring Coordinator), Cindy Kelly (daytime LRC Clerk), and Nichelle Monroe (evening LRC

Clerk). The LRC operates under the direction of Patricia Burson, Associate Dean for Learning Resources, who handles evaluation of the tutoring and support services housed there, including gathering and analysis of data on the impact their services have on student success.

However, it is important to note that the Physical Science faculty have an effective working relationship with the LRC staff and vice-versa. Because we share a common facility, we see each other often in the hallways and staff workroom and interactions are frequent and collegial. Faculty are easily able to update the LRC staff of any curricular, textbook, or other relevant changes. Staff are also able to talk with faculty regarding questions or concerns that arise in their work with science students. When asked, Physical Science faculty reported a high level of satisfaction with the LRC services and staff.

D.2. Moving Forward

1. Discuss and summarize conclusions drawn from data, assessments (SLO, UO) or other evaluation measures identified in Section C and indicate responses or programmatic changes planned for the coming year(s) including

- How the assessment results are informing program goals and objectives, program planning, and decision making.
- Specific changes planned or made to the program based on the assessment results.

The majority of our plans for the coming and future years are presented as a list of objectives in section D.2.2. and as goals in various parts of section G. Here we will briefly summarize some of changes we made in the past six years in our programs as a result of our continual process of self-assessment:

- In Chem 9, analysis of the laboratory exercises led to the development of four new experiments that better correlate with the "everyday chemistry" theme of the course.
- In Chem 10, the strong sense that an equity gap exists led faculty members to create the Chem 10 Bootcamp program to support concurrent Chem 10 students.
- In General Chemistry, the result of SLO analysis causes program faculty to incorporate a question-by-question analysis of the ACS exam in Fall 2019 to get a much more nuanced picture of instructional effectiveness in Chem 11 and Chem 12.
- Success rate analysis in Chem 19 led to the conclusion that specific Chem 19 tutors are needed in the Science LRC. The program faculty and department chair recommended specific Chem 19 students to the Science LRC coordinator and a few of them were hired to start as Chem 19 tutors in Spring 2020.
- Equity gap in calculus-based Physics courses led to the creation of Physics 20. We plan to review the effectiveness of this course in the coming years.
- Our 2018-2019 annual program review noted the deterioration in the working relationship between faculty and stockroom staff due to a myriad of issues. We had since corrected this by implementing an online reporting system for chemistry labs

which are sent to the stockroom staff and department chair. A monthly meeting to review these reports started in July 2019 and had provided effective resolution to many of these issues.

- Faculty input about the lack of response to Science building issues results in the creation of another online form to report facilities, grounds, or custodial issues in the building. Because each copy of this report is automatically emailed to the department chair and administrative assistant, we have observed an improvement in the follow up to the various building issues.

This list is by no means exhaustive and we encourage the reader to look to various parts of sections D.1. and G to understand how our assessment leads to changes in specific programs and disciplines.

2. List the objectives or target goals your program or service area has identified for the coming year. Indicate the number of objectives identified: __2__ . Use the comments section to indicate the reason for the objective (assessment results, changes in data, changes in external factors, etc.). Indicate how each objective or goal links to the division goals.

Objective 1: Work with Risk Management to implement the next steps of safety plan by: a. Reviewing and if necessary, updating the Chemical Hygiene Plan b. Providing safety and chemical hazard training to faculty through online training c. Providing safety and chemical hazard training to chemistry stockroom staff through on-ground workshops d. Reviewing existing chemicals in storage to determine their applicability in our courses and disposing unused ones as needed e. Creating a process to maintain cleanliness in chemistry laboratories f. Properly labeling chemical reagents that are stored in secondary containers		
Area/Discipline/Function Responsible: Chemistry Faculty, Chemistry Staff, Risk Management		
Assessment Data and Other Observations:		
☐ SLO Assessment Data and/or ☐ SUO Assessment Data and/or ☐ UO Assessment Data	☐ TIMS Report Data ☐ Institutional Research Data	☒ Other data or observed trends (briefly describe in the comments field below)
External Factors:		
☐ Program Review Committee Commendation	☐ Program Review Committee Recommendation	☒ Program Review Recommendation for Institutional Support
☐ SMC Strategic Initiative (indicate specific initiatives in	☐ SMC Master Plan for Education Objective #___	Advisory Board Recommendation (for CTE only)

the comments section below)		
☒ Other Factors (briefly describe below): Safety of students and faculty		
Timeline to accomplish the objective: One year		
Describe how objective will be assessed/measured: each of the objectives listed above can easily be measured by whether the specific action described has been fulfilled or not.		
Comments: Increasing safety in the chemistry discipline has been a long-term goal of the department. A recent discovery of potentially explosive chemicals stored in the chemical storage area is a reminder that we need to put this issue front and center. With the help of Mr. Daniel Philips, we have been able to start implementing a few safety measures and we look forward to taking the next steps in the coming year.		

Objective 2: Update and organize Physics laboratory manuals through the following steps: a. Review, rewrite, and reformat existing Physics laboratory procedures b. Move the updated Physics lab procedures to Canvas or some other source that is not the departmental webpage		
Area/Discipline/Function Responsible: Physics Faculty		
Assessment Data and Other Observations:		
☐ SLO Assessment Data and/or ☐ SUO Assessment Data and/or ☐ UO Assessment Data	☐ TIMS Report Data ☐ Institutional Research Data	☐ Other data or observed trends (briefly describe in the comments field below)
External Factors:		
☐ Program Review Committee Commendation	☐ Program Review Committee Recommendation	☐ Program Review Recommendation for Institutional Support
☐ SMC Strategic Initiative (indicate specific initiatives in the comments section below)	☐ SMC Master Plan for Education Objective #___	Advisory Board Recommendation (for CTE only)
☒ Other Factors (briefly describe below): Faculty Discussion		
Timeline to accomplish the objective: One year		
Describe how objective will be assessed/measured: each of the objectives listed above can easily be measured by whether the specific action described has been fulfilled or not.		

Comments: For many years, the Physics faculty had discussed the need to create a more organized laboratory manual. The current versions on the department's webpage came from individual FT faculty's copies, many of which are out-of-date and sometimes can be unclear to those using them for the first time. A new, more organized version of these labs will provide useful not just to students, but also to new faculty who have to teach these courses. Secondly, MIS has indicated that they would like us to move most of our support materials, such as lab documents away from the department webpage. We think this is a convenient time for the Physics faculty to create a storage location for these newly reformatted documents.

E. Curriculum Review

1. Discuss how the department reviews, revises, and creates new curriculum. Include the following information:

- The process by which department members participate in the review and revision of curriculum.
- How program goals and SLOS are integrated into course design and curriculum planning.
- The relationship of program courses to other college programs (cross-listing, overlapping content
- The rationale for any changes to pre-requisites, co-requisites and advisories.
- How the department ensures course syllabi are aligned with the course outline of record..

Each program group in the department meets several times per semester to discuss all issues related to their courses, including SLO assessment and results; student success and retention; enrollment trends; emerging issues and changes within the disciplines; laboratory procedures, supplies, and safety considerations, etc. When warranted, or every six years during program review (whichever comes first), Course Outlines of Record (CORs) are updated.

In this round of review, we had made a major update to all of our CORs. This update involves the reassignment of laboratory and lecture hours so that the calculated course unit matches the Carnegie unit that is listed in the COR. These units are part of the articulation agreement, so it is important that they match the expectation of various transfer institutions.

Another important update involved the addition of Coordination Chemistry and Nuclear Chemistry to the topics covered in Chem 12. Addition of these topics do not affect articulation, but they help in allowing Chem 11 and Chem 12 obtain a Course Identification Numbering System (C-ID). The C-ID for Chem 11 and Chem 12 is needed as both courses are part of a requirement for SMC students to obtain the Associate degree in Transfer (AS-T) in Geology.

Due to changes in the Math curriculum, we had also modified the pre-requisites of Chem 12 and General Physics to include Math 3 and 4 or Math 2. Secondly, we had added Math 50 as an alternative prerequisite to Chem 19. Chem 19 primarily serves students completing a set of courses preparing them for nursing programs and other allied-health programs. One course in that set is Math 54, Statistics. Math 50 is a relatively new course to the college designed as a pre-statistics course to prepare students for Math 54. The topics of Math 50 seem well suited for preparation for Chemistry 19 as well. None of these alternative prerequisites affect articulation.

Lastly, we also made a number of minor revisions, primarily of a "housekeeping" nature, including updates of textbook lists, inclusion of new sample assignments, and separation of objectives for the lecture and laboratory portions of our courses. All the updates discussed here had been approved by the Curriculum Committee in Fall 2019.

F. Community Engagement

1. If applicable, describe how your department staff members engage in institutional efforts such as committees and presentations, and departmental activities.

We are very proud of our talented, devoted, and hardworking department members consisting of twenty full-time faculty, forty-three adjunct faculty, a department secretary shared with Life Science, and three full-time laboratory technicians. It is this team of professionals who make our department and our academic programs extremely successful. It is the culture of the department to do whatever it takes to maintain a high level of academic rigor in our classes while simultaneously providing an environment that encourages each student to do his or her best and get excited about science. Our students continue to transfer to prestigious universities where they do very well academically. They also compete for, and sometimes win, scholarships, research internships, medical and other health professional school admissions, and the like.

Examples of nonteaching activities in which members of our department are currently and/or recently engaged include:

- student club advising
- maintenance of sophisticated scientific instrumentation
- advising/supervising student independent study
- coordinating specific programs within the department

A sizable portion of departmental work falls on the shoulders of our “Program Leaders”, those FT faculty members who coordinate and lead faculty in specific courses to continuously improve the quality of these courses. Throuhgout the year but specifically during program review times, these leaders gather data and conduct discussions with faculty in their programs and spend considerable time helping the department chair provide a holistic view of the department.

In addition to these ongoing efforts to maintain and improve our instructional program in the physical sciences, a number of our department members also contribute to broader campus community and are represented on:

- The Curriculum Committee
- The Institutional Effectiveness Committee
- The Global Citizenship Committee
- The Distance Education Committee
- The Program Review Committee
- The Informational Services Committee
- Academic Senate Executive Committee
- District Planning and Advisory Committee
- The Faculty Association Representative Assembly
- The Faculty Association Leadership
- The District Safety Committee

We are also well-represented as EEO representatives on District hiring committees and as out-of-discipline members of probationary faculty evaluation panels. Several of our faculty members regularly made presentations during flex days and at district workshops on various pedagogical topics. Since the beginning of the College's Redesign of Student Experience project, a number of our faculty have been involved in their roles as content experts.

2. If applicable, discuss the engagement of program members with the local community, industry, professional groups, etc.

Our Physics faculty are members of the American Association of Physics Teachers (AAPT) and the Southern California AAPT (of which Forouzan Faridian is a past president). In Fall 2019, Forouzan Faridian, Steve Paik, Kyle Strohmaier, and others hosted the meeting of the Southern California AAPT at the main campus of SMC, which was attended by over seventy Physics college faculty members from all over the region. In addition, Professor Faridian has led and attended many of SCAAPT workshops over the years.

Under the leadership of Jennifer Hsieh and Travis Pecorelli, our student Chemistry Club (Chem Club) became a student chapter of the American Chemical Society (ACS). The SMC Chem Club has a calendar full of activities including these community outreach events:

- Visit to two local elementary schools (Will Rogers Elementary & Grant Elementary) every semester (every year from 2013) to do hands-on chemistry demonstrations with the CREST after school program
- Host to thirty to sixty middle school students from John Adams Middle School to perform a college level Visible Spectroscopy lab on a Saturday morning once a year since 2016.

In addition, the Chem Club organized and hosted a community event, dubbed the STEM Festival, in Spring 2018 and Spring 2019, serving about 100 preschool through middle school students along with their families. The STEM Festival involved organization of a large number of faculty members, students, and collaboration with various departments on campus including Events, Campus Police, Facilities and others.

In collaboration with Life and Earth Sciences, and with great support from the SMC Associates and Dean of Community and Academic Relations Kiersten Elliott, we are continuing to host the Distinguished Scientist Seminar series. These seminars attract a large audience from within SMC, but also from the surrounding community. Our most recent distinguished scientist was Dr. John Daniel "Danny" Olivas, a NASA astronaut who was invited by Forouzan Faridian. Dr. Olivas was such a captivating speaker that at the lunch following his seminar, no student left until one hour after it was supposed to end.

As part of his work in the SMC Faculty Association, Peter Morse coordinates and plan an annual day-long workshop called the Retirement and Benefits conference at SMC which is open to community college employees across southern California. He regularly writes summaries of statewide retirement conferences that are published by the Faculty Association of California Community Colleges.

Tram Dang is involved as Principal Investigator in a number of grants including ones from the Teagle Foundation and Office of Naval Research, in collaboration with UCLA Engineering faculty. She is also an active member of the Engineering Liaison Council (ELC), an organization whose members are California engineering faculty members. The ELC discusses various topics related to post-secondary engineering education and Professor Dang is both the chair of its Technology Committee and Webmaster.

Since 2017, Jamey Anderson has partnered with UCLA Center for Education Innovation and Learning in the Sciences (CEILS) on an NSF-INCLUDES pilot project. This particular project was designed to tackle the continuing lack of diversity, especially African Americans and Latinxs, in the national STEM faculty at all levels. He also served during the 2018-2019 academic year as the 2-year college representative on the leadership team for the ASPIRE project. Part of this project involved forming the Southern California Regional Collaborative, which works with graduate students interested in careers in pedagogy, as well as with current and future STEM faculty to address the need to increase overall outcomes in STEM higher education, focusing on outcomes of underrepresented groups.

Sehat Nauli served multiple times as a judge for the Intel International Science and Engineering Fair, which takes place annually in May with more than 1500 students from roughly 70 countries.

Roman Ferede regularly involves SMC students in her independent research. Her student had won undergraduate research awards as well as gave presentations at various undergraduate research conferences.

3. Discuss the relationship among and between full and part-time faculty, involvement of part-time faculty in departmental activites, and part-time faculty access to resources and support.

Part-time faculty are invited to and encouraged to attend all department meeting and flex day activities, and a few do. In addition, because of the organization of the department into programs with FT faculty program leaders, a few PT faculty also attend the program meetings where the topics are specifically related to the courses they teach. Agendas for all meetings are distributed to all faculty and staff prior to each meeting via email.

Newly hired part-time faculty are assigned a mentor from the full-time faculty who assists them with syllabus preparation, exam preparation, gaining familiarity with our laboratory facilities and policies as well as course experiments, and serves to answer questions and provide a sounding board for issues and concerns that may arise regarding the teaching of their assigned courses. The department chair also conducts an orientation for each new hire to familiarize him/her with department and college facilities, policies, and procedures.

All faculty are evaluated by a peer according to the procedures outlined in the faculty contract. This provides a formal opportunity for constructive feedback between faculty. Our department is committed to providing thorough, meaningful evaluations to provide every instructor with the tools and knowledge to be a highly effective educator.

Part-time faculty from both Physical Science and Life Science currently share the use of one office as well as common workspace housing three computers in a general faculty/staff workroom. Although having enough private space to conduct office hours has been a continuing issue, PT faculty from both departments are able to share the limited space collegially.

G. Trends, Planning, Recommendations

1. Present any conclusions and recommendations resulting from the self-evaluation process

One of the benefits of Program Review is that it forces us to look carefully at the data and compare that with the anecdotal findings that faculty members have observed. Several chemistry faculty members had commented on the relative drop in Asian P/I students and the relative increase in Latinx students and it’s clear that the data back that observation. This demographic shift requires us to think carefully about how we teach our courses in the future.

A second benefit is it allows us to do an in-depth review of our newer courses, namely Chem 19 and some of the Engineering courses. In the Chem 19 example, the review requires us to think about the specific help needed by the pre-Allied Health students who are enrolled in this course.

Lastly, Program Review also compels us to take care of some existing curricular issues, namely the inconsistencies between our course unit and the actual amount of lecture and laboratory time. Although this has been an issue we discovered some time ago, the occasion of Program Review focuses our effort to fix this important issue that may affect the articulation of some of our courses.

Current Trends, Planning, Recommendations

2. Identify any issues or needs impacting program effectiveness or efficiency for which institutional support or resources will be requested in the coming year. [This information will be reviewed and considered in institutional planning processes but does not supplant the need to request support or resources through established channels and processes].

To help the reader identify our recommendation for institutional support for the coming year, we have highlighted them in the text below.

Safety is top of our mind as we have classes where hazardous chemicals are in constant use. The department is pleased that the College hires a new Safety Officer, Mr. Daniel Phillips. He has been attending our department staff meetings, working with our lab technicians, and has begun implementing safety protocols and new work flows that will positively impact our program. His continued work with us will be critical in shoring up our safety protocols, and it is our hope that he continues to work closely with us in coming years.

One of the changes that Mr. Phillips plan to implement is training for faculty and the chemistry laboratory technicians. Prior to his arrival, our annual faculty safety training has often consisted essentially of re-reading of the District's Chemical Hygiene Plan by a contractor from Keenan and Associates, the company that the College works with on various risk management issues. Mr. Phillips had revamped the training for the lab technician so that now they watch online videos, about 15-20 minutes long, about various safety issues. Faculty can take the same training, however there have been concerns over how the time spent may not be keeping with the faculty contract. One possible solution is to give "flex credit" to faculty based on the total amount of time needed to watch these videos, but as a department we cannot move forward as this issue pertains to the faculty contract. We hope the District and the Faculty Association can reach an agreement on this issue shortly, so we can start these faculty safety trainings.

A related issue is the training of our chemistry stockroom technicians. Once Mr. Phillips was hired, we found out that there is a myriad of safety procedures that our stockroom staff is not well-versed about. For example, all chemicals placed in a secondary container, i.e. a container that is different from the one the chemical is shipped in, should have a label that shows some of the properties of the chemical, whether pictorially or in words. Once we understood this need, our stockroom technician had started to create such a list for all our chemicals and we should have labels by the end of Spring 2020.

The limited background in safety procedures that our stockroom technicians have is not their fault. They were hired based primarily on their ability to prepare various reagents needed for our chemistry laboratory experiments and not on their safety knowledge. In their current roles however, they need to practice safe handling of chemicals and train SMC student workers to do the same. In Fall 2019, the department chair received information about a 2-day safety training costing about $600 that will be appropriate for our lab technicians, but we could not enroll them due to a lack of funding. We think it is critical that the District adds funds to the department's budget for the purpose of training of our stockroom staff in safety issues.

One other need that comes up continually, but seems to be causing more problems than ever, is the lack of DSPS proctoring for night and late afternoon classes. Early closures of offices and proctoring centers due to budgetary constraints are understandable, but with the increases in numbers of DSPS students, these problems cause large strain around final exams and during midterm exam weeks, resulting in student complaints, as well as misunderstandings between faculty and DSPS personnel. In the past, the suggestion was made that faculty could allow night students to take exams in quiet rooms, and ensure the extra time was given to the student. Recently however, fewer and fewer students are willing to take exams outside of the proctoring center, many times for good reasons involving a specific type of accommodation, beyond extra time. But this leads to legitimate faculty concerns around exam security when students take the exam days before or after the rest of the class. It is unreasonable to expect night instructors to come up with "DSPS" version of every examination instrument each semester. Additionally, when instructors do give different exams, this has led to occasional students claims of unfair treatment and retaliation for being DSPS students. With so much on the line for DSPS students and their success, it seems reasonable to ask that the College provides funding for SMC Center for Students with Disabilities so they can be open in the evening.

3. If applicable, list additional capital resources (facilities, technology, equipment) that are needed to support the program as it currently exists. [This information will be reviewed and considered in institutional planning processes but does not supplant the need to request support or resources through established channels and processes].

The Science building is now over twenty years old. Those who had worked in this building since its start know that there were always problems associated with the heating, cooling, and air flow in the lab wing on the east side of the building. Unfortunately, as the building ages, these problems have become magnified.

It is not uncommon that temperatures will vary from 55°F to 85°F from week to week, as measured by thermometers we have in each of these rooms. On January 29, 2020, the south end of the building had temperature of 87°F, while the north end was at 65°F. The chemical fume hoods intermittently seem to pull a tremendous amount of air, going into emergency flow mode. When this occurs, the fume hood alarm starts to beep at intervals of ten minutes. This constant interruption prevents any effective teaching or learning activities to take place. The extreme temperature swings and malfunctioning fume hoods seemed to take a turn for the worse when the Science building ventilation system was connected to the new centralized cooling system on campus.

Another perennial issue is the strong negative pressure inside the building on all floors. This causes the doors to be difficult to open, and slam shut with tremendous force, creating a hazard for all passing through doorways. It has been better this year, but it still occurs from time to time, and we've heard that it results from the need to replace aging fan systems throughout the building, which apparently now have just stopped working.

A large number of faucets in Science 305 leak and have damaged the wood cabinets and lockers in the room. We had reported these leaks several times to Maintenance, but it is not clear to us whether they have been fixed. Gas smells often appear in Science 332, requiring instructors or stockroom technician to shut off the main gas valve. Maintenance told us that they were not able to find the source.

Ceiling tiles that fall into the classroom have also been an ongoing concern. Much of our laboratories have had clips installed to prevent tiles from falling, although there are a few rooms where that work is not 100% complete. Once the clips are installed, this can delay the ceiling tiles from falling, but not prevent it completely. We occasionally still have ceiling tiles showing warp or damage that eventually fall, in spite of being clipped.

Recently, the department chair was informed by the Director of Facilities that a new, multi-million-dollar ventilation system will be installed in June 2020 to replace our current one. We are hopeful that this new system will take care of many of the air flow issues discussed above. We also ask that the College provides funding to replace the ceiling tiles in these rooms.

Due to the building issues just mentioned, our administrative assistant files a large number of work orders to Maintenance. We were rarely informed of the status of these work orders by Maintenance. As a result, the administrative assistant resubmits the work orders again and again. Not only is this process inefficient, but it is also frustrating to everyone involved. We ask that the District supports the implementation of a work order update system for the Facilities department. This system can be similar to the one used by MIS (IThelp@smc.edu) which provides status update of a work order request as it is being processed by various support staff.

4. If applicable, list additional human resources (staffing, professional developemnt, staff training) that are needed to support the program as it currently exists. [This information will be reviewed and considered in institutional planning processes but does not supplant the need to request support or resources through established channels and processes].

The hiring of a new full-time faculty in 2015 to develop and grow our Engineering program has paid off dividends. As described in sections B.1., D.1.3., and F.2., the increase in the number of new courses, enrollment, new part-time faculty, grants, and facility improvement have been off the charts. The lion’s share of this work has fallen on the shoulders of the lone Engineering faculty, Professor Tram Dang. Although Professor Dang was given three hours of reassigned time for this work, they were nowhere near the amount of time that she actually contributed to the program. Due to the number of loads for the Engineering courses though, Professor Dang ended up still having to teach some Physics courses in order to fulfil the faculty contract.

We anticipate further development of the Engineering program in the near future. Specifically, two courses, Engineering 31 and 32 on Materials Sciences, are being developed even now. We ask that the College supports our request to hire another full-time position that will be half Physics and half Engineering to help support Professor Dang and the burgeoning Engineering program.

Our full-time faculty hiring in Chemistry has been only keeping pace with retirements, but recently this has lagged somewhat. The following retirements are not yet replaced: one in 2016, one to occur at end of Spring 2020, and one more in the coming year or two. All of these positions are in organic chemistry, which means we are in critical need of several new organic chemists.

Organic chemistry courses involve more complex procedures and hazardous chemicals in the laboratory. Traditionally at SMC and most community colleges, only full-time faculty members teach organic chemistry courses. This is because many part-time faculty members do not have a background in the discipline that allow them to handle the chemical waste, instrumentation, and highly toxic or flammable substances found in the organic chemistry laboratories. We had tried assigning part-time faculty members to teach these courses in the past. Unfortunately, we noticed a significant decrease in rigor and safety in these classes when they were taught by adjunct faculty. Due to large number of retirements in organic chemistry and the capstone nature of this series of courses, we ask that the District hires *at least* one full-time faculty for organic chemistry next year.

Lastly, we have shared one full-time department administrative assistant with the Life Sciences department since the mid 1990s. The two departments are the third and fourth largest departments on campus, so the amount of administrative tasks is quite overwhelming for one person to handle. As interest in STEM majors continues to be strong, we do not see any let up in the responsibilities that our administrative assistant must take on. We ask that the District gives us another half-time administrative assistant. We ask to have this new staff member for the coming year because it will take her time to train a new administrative assistant to learn the specific details of these two departments.

5. List all current positions assigned to the program

The department consists of twenty full-time faculty, forty-three adjunct faculty, a department secretary shared with the Life Sciences department, and three full-time laboratory technicians.

Future Planning and Recommendation

6. Projecting toward the future, what trends could potentially impact the program? What changes does the program anticipate in 5 years; 10 years? Where does the program want to be? How is the program planning for these changes?

With the guidance from Mr. Daniel Phillips, we look forward to creating Standard Operating Procedures (SOPs) for the various laboratory chemicals that we have. Having SOPs is a common safety requirement mandated by the Occupational Safety and Health Administration (OSHA). We had tried some years ago, before Mr. Phillips was hired, to create our own SOPs. Over a two-year period, we were able to create just two SOPs out of an estimated 25-50 that we will eventually need. Mr. Phillips's experience and know-how of the legal requirements will help a long way in helping us determine the most efficient way to accomplish this goal.

There is a new trend in biology programs of 4-year transfer institutions in creating chemistry courses specifically designed for the life sciences. Already, SMC life science faculty have approached the department in hopes of creating a sequence with fewer units that covers the essentials of chemistry for life sciences. This would significantly change enrollment and scheduling patterns in chemistry, and we would need to work closely with other local faculty while creating these new courses. Currently, life science majors must take five-semesters of chemistry (Chem 10, 11, 12, 21, 22), so reducing the number of chemistry courses for these students sounds reasonable to us. Working together with colleagues in the Life Sciences department, we plan to start a discussion to adapt existing courses or create new ones to satisfy the needs of this group of students.

Enrollment in our pre-Nursing and pre-Allied Health chemistry, Chem 19 keeps increasing at a high rate. In Spring 2020, we are offering seven sections of Chem 19, the most we ever have, and the fill rate of all sections is above 95%. Although we saw a slight drop in Chem 10 enrollment once Chem 19 started, it was not a precipitous drop as some of us had worried about. With the addition of this new group of Chem 19 students, we have had to squeeze in Chem 19 labs wherever we could and it is clear that the current Science building, with all its attendant problems described in G.1., cannot handle this influx. We look forward to the construction of the new Math/Science Addition building which will allow us to once again grow the number of chemistry sections.

A related challenge with Chem 19 is ensuring that the appropriate students enroll in Chem 19 versus Chem 10 or STEM-pathway chemistry. A non-scientific survey of a Chem 10 double section in Fall 2019 found that 20% of the students were pre-Nursing students who should be taking Chem 19 instead. Students still seem concerned that Chem 19 will not fulfil the pre-requisite for Nursing programs, even though it does for all the CSU. In addition, some students think that they must take Chem 10 to take SMC Physiology and Microbiology, when as a matter of fact, the instructors in those courses prefer that the students take Chem 19. Our department plans to communicate more clearly to SMC counselors and students about Chem 19 and how it compares to Chem 10.

A last note about Chem 19 is the clear support that the pre-Allied Health students need to succeed in this and other courses they are taking such as Physiology and Microbiology. Our department is interested in partnering with other departments, e.g. Life Sciences and Math to come up with methods to support these students which may include:

- Establishing student cohorts who study and take classes together similar to the SRI program
- Setting up extra recitation session similar to the Chem 10 Bootcamp,
- Setting up a bridge program in summer and/or winter sessions
- Incorporating Supplemental Instruction
- Developing a one-unit support course that starts a few weeks into the semester and runs for 8-12 weeks,
- Working with the Science LRC to develop tutors suitable for Chem 19 and its students

With the organic chemistry laboratory in the new building, we look forward to finally meeting the ACS-recommended laboratory size of twenty-four students instead of our current twenty-eight student labs. This reduction in lab size will have an important consequence in the ability of the instructor to run the lab safely. The impact of the change in section size on scheduling is not yet clear. If current trends of steady or slightly declining enrollment in organic chemistry continues, then the reduced lab size will end up yielding the same number of sections.

The final issue facing chemistry is the eventual phasing out of the Chem 10 Challenge Exam. With the recent implementation of AB 705, we were particularly worried that we will have to immediately remove our Chem 10 Challenge exam, which we have used to determine the eligibility of students to take Chem 11. After further research, we learned that AB 705 will likely not extend to the sciences, however we think it is still important that the department rethinks its method of placing students in either Chem 10 or Chem 11. Ideally, we would like a placement tool that will emphasize the rigor needed to succeed in chemistry classes, but also provide support for groups who have traditionally been underrepresented in chemistry. In future years, we will discuss instruments incorporating multiple measures that we can use to determine placement into Chem 10 versus Chem 11.

As discussed in sections B.1. and C.4., our Physics for Engineering series has experienced healthy enrollment growth due to interest in STEM generally and Engineering specifically. There have been interest among the Physics faculty to redesign some of the laboratory exercises, so they can take advantage of some of the newer equipment that was purchased by the Engineering program. This will be a longer-term project that the Physics faculty will focus on once they finish the shorter-term rewriting of the current lab procedures.

A few full-time faculty members have expressed interest in starting a hybrid online/on-ground version of some of our classes. Based on recent information from various other departments, it is clear that online and hybrid courses are growing while on-ground courses seem to be losing students. Although our department's on-ground course enrollment is very healthy, we think that online is the direction that many students are going towards in the future. We want to anticipate this trend by creating hybrid courses that match the high quality and rigor of our on-ground courses. We look forward to take part in the College's discussion of setting up fully online degrees and we want our courses to be part of this effort.

We are very excited about the new science building in part because it will help to address our needs as outlined in our previous six-year review, but also because it will place our department in close proximity to our Earth Science and Math colleagues, thereby generating new opportunities for collaboration and interdisciplinary initiatives.

7. If applicable, list additional capital resources (facilities, technology, equipment) that are needed to support the program as it currently exists. [This information will be reviewed and considered in institutional planning processes but does not supplant the need to request support or resources through established channels and processes]..

Since the opening of the current Science building over twenty years ago, there has been such tremendous expansion of our course offering that soon we will not be able to meet student demand for some courses, Chem 19 or Physics for Engineers, due to insufficient laboratory and classroom space. Our introductory, general, and organic chemistry labs are booked from 7:15 a.m. all the way to 10:30 p.m. Monday through Thursday. Friday classes start at the same time and end only slightly earlier. We could still fill additional sections of Chem 9, 11, and 19 if space was available. Our Physics for Engineering series has also been growing fast due to the influx of Engineering majors and it has become clear that laboratory space will constrain the growth of this program, particular for the lab space used for the Electricity and Magnetism course.

We look forward to the start of construction of the Science/Math Addition (SMA) building. We are slated to receive one organic chemistry lab space with a smaller organic chemistry stockroom attached to it and a shared lecture room. This will relieve some of the pressure on Science 305, which currently serves as lab space for all the organic chemistry courses and Chem 19. Due to the specialized design of Science 305 (and the adjoining instrument room, Science 303) however, it will need to be retrofitted before it can be effectively used as a lab space for the other chemistry labs. We ask that the District provide funding to support this retrofitting, which will need to take place once the SMA building has been completed.

Many of our laboratory instruments are as old as the Science building and will need to be replaced soon. For example, we have two gas chromatographs that were used for the organic chemistry experiments that are currently not functioning. This means that students cannot collect gas chromatography data which is commonplace in college organic chemistry labs. We ask that the District provide increased funds to our budget in the coming years so we can slowly rotate out of our old equipment and bring our laboratory instruction to the 21st century.

8. If applicable, list additional human resources (staffing, professional development, staff training) that are needed to support the program as it currently exists. [This information will be reviewed and considered in institutional planning processes but does not supplant the need to request support or resources through established channels and processes].

As discussed in G.4., our administrative assistant is supporting two very large departments. It is not uncommon that administrative tasks do not get completed in a timely manner. This situation cannot continue as both departments are only getting larger due to interest in STEM majors. As shown in section B.2., enrollment in the Physical Sciences department increases, while the College's enrollment decreases. In the short run, we ask that the College provides another half-time administrative assistant position to be shared by the two departments. In the long run, a more sustainable practice is to give each department its own administrative assistant.

Once the new SMA building opens, we will have an additional stockroom dedicated to organic and biochemistry labs. We currently have two chemistry stockroom technicians covering two shifts from 7:30 a.m. to 10:30 p.m. It is not possible to ask one of them to cover the new organic chemistry stockroom in the SMA building, as that will leave no one in the regular chemistry stockroom in the Science building. We ask that the District hires a new part-time stockroom technician to be stationed at the organic chemistry stockroom in the new SMA building.

In Physics, the current lab technician was someone who used to work in the Electronics program before it was disbanded. He has close to forty years with SMC and is likely to retire soon. In the near future, the Engineering program will have its own lab, with tools such as a table saw, a circular saw and a drill press. For safety reasons, use of these tools will require constant monitoring by a staff member. This lab will be located in Drescher Hall 109, separated from the rest of our program in the Science building. As a result, it is not possible have Physics and Engineering share one lab technician. With the growth of the Engineering and Physics program, we ask that the District seriously consider hiring a staff technician for each program.

As equity issues become front and center, we welcome more professional development for new and existing faculty to practice equity-centric pedagogy in their classroom. This training however, should be geared towards the STEM disciplines as opposed to the broader training the College offered in recent years. In addition, the training should be carefully designed to provide clear guidance, measurable data, and feedback to instructors so they can increase their equity awareness over time. For faculty members to fully engage in the process, the College has to be willing to provide some paid time for this training. The new NSF grant, which seeks to foster an equity-minded culture in STEM faculty at SMC, is moving in the right direction as there is a component of reassigned time for participation in the program. We are excited to have some of our faculty take part in this effort and help close the equity gap in the department and College overall.

As discussed in section C.1., our Introductory Chemistry program (Chem 9 and Chem 10) have the largest number of sections offered, but the smallest number of full-time faculty involved. This area is also where we have the largest number of underrepresented students. Unless the District supports the hiring of more full-time faculty members to teach these courses, our efforts to close the equity gap in this program will not be consistent. We ask that the District allots a full-time faculty spot for our Introductory Chemistry program. This faculty can even share a load in General and Organic Chemistry as well.

9. If applicable, note particular challenges the program faces including those relating to categorical funding, budget, and staffing.

As discussed in various parts of section G, we need increased funding for the following reasons:

- Training in safety protocols for our chemistry stockroom technicians
- Replacement of old equipment in chemistry and physics laboratories.
- Retrofitting of Science 303 and 305 to serve as laboratory spaces for non-organic chemistry courses.

10. Please use this field to share any information the program feels is not covered under any other questions.

N/A