COLLEGE of SAN MATEO

PROGRAM REVIEW AND PLANNING

Approved 9/2/08 Governing Council

The Program Review process should serve as a mechanism for the assessment of performance that recognizes and acknowledges good performance and academic excellence, improves the quality of instruction and services, updates programs and services, and fosters self-renewal and self-study. Further, it should provide for the identification of weak performance and assist programs in achieving needed improvement. Finally, program review should be seen as a component of campus planning that will not only lead to better utilization of existing resources, but also lead to increased quality of instruction and service. A major function of program review should be to monitor and pursue the congruence between the goals and priorities of the college and the actual practices in the program or service.

~Academic Senate for California Community Colleges

Department or Program:
Division:

I. DESCRIPTION OF PROGRAM

The Chemistry program offers the first two years of chemistry courses to serve two major tracks:

1) The first two years of chemistry required for a baccalaureate in various majors such as biology, chemistry, engineering etc.
2) Various chemical courses required for certificate or two year programs such as nursing, dental assisting, lab technologist etc.

Courses offered in chemistry include:

Chem 192 Elementary Chemistry – a first introductory course in chemistry for non-science majors, remedial preparation or some certificate programs. Prereq: Math 110 or one semester algebra. Recommended: enroll concurrently in MATH 115 or MATH 120 or 122.

Chem 210 General Chemistry I – first semester general chemistry for science majors. Prereq: CHEM 192 with a grade of C or better or equivalent; MATH 120 with a grade of C or better. Recommended: eligibility for ENGL 838/848 and one course in physics.

Chem 220 General Chemistry II – second semester general chemistry for science majors. Prereq: Chem 210 with a grade of C or better.

Chem 231 Organic Chemistry I – first semester organic chemistry for science majors. Prereq: Chem 220 or 225.

Chem 232 Organic Chemistry II – second semester organic chemistry for science majors. Prereq: Chem 231

Chem 250 Analytical Chemistry Quantitative Analysis – Introduction to chemical analytical procedures. Prereq: Chem 220 with a grade of C or better.

Chem 410 Health Science Chemistry I – a first introductory course in general chemistry for some health professions. Prereq: None Recommended: MATH 110 or one semester course of algebra, eligibility for ENGL 848.

Chem 420 Health Science Chemistry II – a first introductory course in organic/biochem for some health professionals. Prereq: Chem 410

II. STUDENT LEARNING OUTCOMES

a. Briefly describe the department's assessment of Student Learning Outcomes. Which courses or programs were assessed? How were they assessed? What are the findings of the assessments?

All SLO's for courses were completely written by school year 2008-2009. (Also department level SLO's were delineated.)
Assessment cycle 1 for the first 3 SLO's of CHEM 192 and CHEM 410 completed Fall 2008.
Method used: Multiple choice examination of 42 questions correlated to 3 SLO's.
Outcomes: A percentage score profile of students that would overlap typical grade distribution.
Assessment cycle 1 for the first SLO of CHEM 210 completed Fall 2008.
Method used: Evaluation of a common laboratory exercise.
Outcomes: A profile of >70% completion of laboratory exercise.

b. Briefly evaluate the department's assessment of Student Learning Outcomes. If applicable, based on past SLO assessments, 1) what changes will the department consider or implement in future assessment cycles; and 2) what, if any, resources will the department or program require to implement these changes? (Please itemize these resources in section VII of this document.)

After attending an SLO meeting several of the chemistry faculty suggested a new possible student oriented SLO evaluation strategy which would involve a questionnaire based approach. We decided to implement and assess this new strategy because of the shortcomings of the previous attempts. Specifically the exam based approach gave results that paralleled grades but was difficult to assess owing to the problem of too much data. The laboratory based approach was overly simplified and gave too little data for a meaningful evaluation.

We have decided to develop a web based student oriented questionnaire for Chemistry 410 and 192 that will query the student's perception of their achievements in mastering the SLO set in these particular chemistry courses. It is hypothesized that this approach will give a more easily evaluated pattern of SLO accomplishment and will be based on direct student experience of their mastery. If this approach proves successful and easy to implement it will be extended to the other SLO's for the remaining chemistry courses.

c. Below please update the program's SLO Alignment Grid. The column headings identify the GE-SLOs. In the row headings (down the left-most column), input the course numbers (e.g. ENGL 100); add or remove rows as necessary. Then mark the corresponding boxes for each GE-SLO with which each course aligns. The definitions of the GE-SLOs can be found on the CSM SLOAC website: http://www.smccd.net/accounts/csmsloac/sl_sloac.htm (click on the "Institutional" link under the "Student Learning Outcomes" heading.) If this Program Review and Planning report refers to a vocational program or a certificate program that aligns with alternative institutional-level SLOs, please replace the GE-SLOs with the appropriate corresponding SLOs.

GE-SLOs g Program Courses i	**Effective Communication**	**Quantitative Skills**	**Critical Thinking**	**Social Awareness and Diversity**	**Ethical Responsibility**
CHEM 192	**X**	**X**	**X**		
CHEM 210	**X**	**X**	**X**		
CHEM 220	**X**	**X**	**X**		
CHEM 231	**X**		**X**		
CHEM 232	**X**		**X**		
CHEM 250	**X**	**X**	**X**		
CHEM 410	**X**	**X**	**X**		
CHEM 420	**X**		**X**		

III. DATA EVALUATION

a. Referring to the Enrollment and WSCH data, evaluate the current data and projections. If applicable, what programmatic, course offering or scheduling changes do trends in these areas suggest? Will any major changes being implemented in the program (e.g. changes in prerequisites, hours by arrangement, lab components) require significant adjustments to the Enrollment and WSCH projections?

Chemistry has seen a year over year enrollment increase from 2005 to 2009. Head count up 6% and WSCH up by 10%. Much of this upward enrollment has been driven by an increase in demand for chemistry for biology and health field training. With this in mind one of the chemistry faculty members is becoming involved in the development of a course for biochemistry training in cooperation with the biology faculty. Additionally there is now a robust offering in BOTH semesters of health chemistry with two faculty members contributing to second semester health chemistry. (In years prior to 2001 this course was barely viable.)

b. Referring to the Classroom Teaching FTEF data, evaluate the current data and projections. If applicable, how does the full-time and part-time FTE affect program action steps and outcomes? What programmatic changes do trends in this area suggest?

FTEF has climbed from 12.55 to 14.95 during the 2005 to 2008 timeframe. Two class sections have been added to the general chemistry offerings and 3 sections to the organic chemistry offerings raising the total section count from 35 to 40. Although the % full time has climbed to a high of 57% this is significantly below the 70% level suggested by the American Chemical Society Guidelines for two year colleges. In order to be effective, chemistry departments need a robust full time faculty. This is dictated by the need for technical program development such as laboratory experiments, modern laboratory equipment maintenance, computer development and the like. Chemistry, like all modern science, is supported by exposure to modern scientific equipment and related experimentation. This exposure comes at a cost both in human and laboratory resources. It is imperative to invest adequately in these resources so our scientific program is not compromised.

c. Referring to the Productivity data, discuss and evaluate the program's productivity relative to its target number. If applicable, what programmatic changes or other measures will the department consider or implement in order to reach its productivity target? If the productivity target needs to be adjusted, please provide a rationale. (Productivity is WSCH divided by FTE. The College's general target productivity will be recommended by the Budget Planning Committee.)

Overall chemistry has a good productivity number - often around 500. One factor which lowers this number is the offering of necessary second year courses such as organic chemistry labs and analytical chemistry which both need to have smaller sections. The chemistry program could potentially be expanded by offering more sections of chemistry 192; however, this would require additional human and facility resources which are not currently available. Plus, it would require more advisement of underprepared students to steer them towards a preparatory course. It is suspected that some student populations would benefit from this, such as the minority groups which currently have underperforming success rates; however, more departmental resources would be needed to actualize this.

IV. **STUDENT SUCCESS EVALUATION AND ANALYSIS**

a. Considering the overall "Success" and "Retention" data from the Dimension section of Core Program and Student Success Indicators, briefly discuss how effectively the program addresses students' needs relative to current, past, and projected program and college student success rates. If applicable, identify unmet student needs related to student success and describe programmatic changes or other measures the department will consider or implement in order to improve student success. (*Note that item IV b, below, specifically addresses equity, diversity, age, and gender.*)

At the current levels of 75% and 85% the success and retention rates of the chemistry program are quite good especially for a physical science which depends upon high level math and cognitive reasoning skills. Many of our students come to CSM with challenges in these areas so the math and science departments at CSM should be commended for the admirable accomplishment of contributing to the success of so many students. Any actions chemistry takes in isolation from the overall math science department would not necessarily lead to improvements in these rates. However it might be surmised that resources such as the math lab and integrated science center have contributed to our overall student success. These and other related resources should be maintained.

b. Briefly discuss how effectively the program addresses students' needs specifically relative to equity, diversity, age, and gender. If applicable, identify unmet student needs and describe programmatic changes or other measures the department will consider or implement in order to improve student success with specific regard to equity, diversity, age, and gender.

The most successful ethnicity in chemistry is Asian followed by white. ((Black and native American are under-represented making the data meaningless). It is obvious from the data that groups that are under-represented in science are succeeding at significantly less than average rates with Hispanic success rates at the bottom. This is in agreement with many external studies and general trends noted by the American Chemical Society. This is a societal socioeconomic problem that will not go away with quick fixes at a program level. These low success groups are plagued by various disadvantages and any improvements will of necessity come from a group effort spread throughout various educational divisions. CSM must therefore maintain a commitment to basic education, remedial courses, tutoring and learning centers and where ever possible renew it's commitment to programs which foster learning communities.
With regard to sex the percent success is even (within a percentage point) so there are no apparent actions to take in this regard.

V. REFLECTIVE ASSESSMENT OF INTERNAL AND EXTERNAL FACTORS AND PROGRAM/STUDENT SUCCESS

a. Using the matrix provided below and reflecting on the program relative to students' needs, briefly analyze the program's strengths and weaknesses and identify opportunities for and possible threats to the program (SWOT). Consider both external and internal factors. For example, if applicable, consider changes in our community and beyond (demographic, educational, social, economic, workforce, and, perhaps, global trends); look at the demand for the program; review program links to other campus and District programs and services; look at similar programs at other area colleges; and investigate auxiliary funding.

	INTERNAL FACTORS	EXTERNAL FACTORS
Strengths	Small but dedicated faculty that is actively engaged in student success. New physical plant facilities with multimedia support. Responsive division leadership.	Community support in willingness to support bonds for new facilities.
Weaknesses	One too few full-time faculty members for robust program. Too few support technicians – there is need for lab technicians, tutoring support, safety technician and night-class support staffing.	Unwillingness to fully fund necessary instructional and staffing needs at the state level. Misguided educational rules that removed modest laboratory fee structure to support chemical and equipment needs.
Opportunities	Dedicated faculty that is responding to external needs for special training such as forensics, biotechnology, nursing, and lab technicians.	Biotech, health care and related industries that all need chemical training. Perhaps more working relationships could be developed?
Threats	Low budgets for equipment and maintenance and/or replacement of broken equipment such as glassware.	State budgets both availability and budgeting process – especially with regards to the community college sector vs the other CA educational sectors.

b. If applicable, discuss how new positions, other resources, and equipment granted in previous years have contributed towards reaching program action steps and towards overall programmatic health (you might also reflect on data from Core Program and Student Success Indicators). If new positions have been requested but not granted, discuss how this has impacted overall programmatic health (you might also reflect on data from Core Program and Student Success Indicators).

New faculty position granted in the 2008-2009 school year has resulted in an increased ability to address the department workload not only with regard to reports and required paperwork; but also to effectively cover necessary course loads. This is especially critical with the recent expansion of the organic chemistry emphasis of students majoring in various health professions.

VI. **Action Steps and Outcomes**

a. Identify the program's action steps. Action steps should be broad issues and concerns that incorporate some sort of measurable action and should connect to the Educational Master Plan, the Division work plan, and GE- or certificate SLOs.

Program actions for the current 2010 year include:

1) Implementation of a student centered SLO survey that will be delivered via the Web. This is a pilot study to see if this modality will be useful in SLO evaluation.
2) Critical work is being undertaken to better manage the glassware used by various laboratory sections. Currently there is a fairly large stream of "broken" glassware that must be accounted for; otherwise, the chemistry budget will be adversely affected. It is not clear for example whether students can be charged for broken glassware and through what mechanism this could be implemented.
3) New textbook decisions are being made for several chemistry courses which would be implemented in the Fall 2010 semester – this will require new outlines and lab schedules be developed to compliment the new texts.

b. Briefly explain, specifically, how the program's action steps relate to the Educational Master Plan.

1) SLO evaluation is an on-going process which will directly feedback to how well the students are mastering basic chemical principles.
2) Expensive glassware could subvert money that could be used to augment and enhance other aspects of the student's learning. Breakage is a contentious issue that must be solved effectively so that financial resources can be properly diversified.
3) New text books are the interface between the students and the instructors and greatly affect the mastery of the subject matter.

c. Identify and explain the program's outcomes, the measurable "mileposts" which will allow you to determine when the action steps are reached.

1) It is hoped that SLO evaluation summaries can be developed (perhaps in graph format) which will guide the department in needed course reforms or additional topics which would facilitate student mastery of chemical principles.
2) Budget improvements will result from any savings derived from solving the glassware issue.
3) Student performance will hopefully be enhanced or maintained by appropriate text books. Additionally, whenever possible there will be a attempt to improve text affordability.

VII. SUMMARY OF RESOURCES NEEDED TO REACH PROGRAM ACTION STEPS

a. In the matrices below, itemize the resources needed to reach program action steps and describe the expected outcomes for program improvement.* Specifically, describe the potential outcomes of receiving these resources and the programmatic impact if the requested resources cannot be granted.

**Note:* Whenever possible, requests should stem from assessment of SLOs and the resulting program changes or plans. Ideally, SLOs are assessed, the assessments lead to planning, and the resources requested link directly to those plans.

Full-Time Faculty Positions Requested	**Expected Outcomes if Granted and Expected Impact if Not Granted**	**If applicable, briefly indicate how the requested resources will link to achieving department action steps based on SLO assessment.**
One full-time professor	Full support for the two major divisions within the chemistry program (organic and inorganic focus) Ability to extend and develop student learning resources for chemical education.	Increased ability to actively improve course offerings such as biochemistry exposure. Improved ability to respond to departmental workload to insure course suitability and improvement. Help maintain and acquire appropriate scientific instrumentation in the department.

Classified Positions Requested	**Expected Outcomes if Granted and Expected Impact if Not Granted**	**If applicable, briefly indicate how the requested resources will link to achieving department action steps based on SLO assessment.**
One more lab technician	Better support for lab and equipment maintenance and to help with CSM chemical safety issues.	Ability to perform experiments with direct educational impact.

b. For instructional resources including equipment and materials, please list the exact items you want to acquire and the total costs, including tax, shipping, and handling. Include items used for instruction (such as computers, furniture for labs and centers) and all materials designed for use by students and instructors as a learning resource (such as lab equipment, books, CDs, technology-based materials, educational software, tests, non-printed materials). Add rows to the tables as necessary. If you have questions as to the specificity required, please consult with your division dean. Please list by priority.

Resources Requested	Expected Outcomes if Granted and Expected Impact if Not Granted	If applicable, briefly indicate how the requested resources will link to achieving department action steps based on SLO assessment.
Item: MeasureNet Stations **Number:** 3 **Vendor:** MeasureNet **Unit price:** $1600 **Total Cost:** $5300 **Status*:** New	Complete the general and analytical laboratory data stations so all labs have the ability to collect and measure experimental data.	Small instruments and data stations complete the student's exposure to modern scientific data collection and analysis techniques.
Item: Colorimeter Probes **Number:** 10 **Vendor:** MeasureNet **Unit price:** $500 **Total Cost:** $5500 **Status*:** New	Complete the most expensive probes for the MeasureNet data stations so all the labs can do spectroscopic measurements.	
Item: GC Mass Spec **Number:** 1 **Vendor:** Labx **Unit price:** $30,000 **Total Cost:** $35,000 **Status*:** New	Expose second year organic students to a typical mainstream scientific instrument that is heavily used in industrial settings.	
Item: Mel Temp 3 Digital **Number:** 2 **Vendor:** Fisher Scientific **Unit price:** $4000 **Total Cost:** $8000 **Status*:** New	These units are to help the workflow in organic labs since additional students are being added.	
Item: Metler Toledo Balance **Number:** 1 **Vendor:** Fisher Scientific **Unit price:** $3500 **Total Cost:** $3500 **Status*:** New	To help the workflow in organic labs.	
Item: Molecular Model Kit **Number:** 1 **Vendor:** Sargent Welch **Unit price:** $350 **Total Cost:** $350 **Status*:** New	To help students with the visualization of important molecules in chemistry lecture settings.	

** Status = New, Upgrade, Replacement, Maintenance or Repair.*

VIII. **Course Outlines**

a. By course number (e.g. CHEM 210), please list all department or program courses included in the most recent college catalog, the date of the current Course Outline for each course, and the due date of each course's next update.

Course Number	Last Updated	Six-year Update Due
CHEM 192	3/9/88	Spring 2010
CHEM 210	9/16/04	Fall 2010
CHEM 220	8/19/04	Fall 2010
CHEM 231	4/23/09	Spring 2015
CHEM 232	3/12/09	Spring 2015
CHEM 250	3/09/07	Spring 2013
CHEM 410	4/87	Spring 2010
CHEM 420	2/88	Spring 2010

IX. **Advisory and Consultation Team (ACT)**

a. Please list non-program faculty who have participated on the program's Advisory and Consultation Team. Their charge is to review the Program Review and Planning report before its submission and to provide a brief written report with comments, commendations, and suggestions to the Program Review team. Provided that they come from outside the program's department, ACT members may be solicited from faculty at CSM, our two sister colleges, other community colleges, colleges or universities, and professionals in relevant fields. The ACT report should be attached to this document upon submission.

Dr Robert Kowerski
Darryl Stanford
The ACT review was submitted as comments on the program review document and edits were made where appropriate. Several important comments were summarized below:

Many of the course prerequisites do not have matching schedule and catalog wordings. Many of these are wording changes rather than major disagreements in content but should be corrected.
Load numbers for chemistry while averaging at an average range that is acceptable are being affected by necessary low enrollment courses such as organic chemistry and analytic chemistry. Improvements should be attempted wherever possible.
Consider that whenever lab coursework involves groups there is a "built-in" social awareness and diversity factor especially if the groups are rotated among all the classmates.
Perhaps evaluate the feasibility of using plastic glassware whenever accuracy and precision are not necessary. Industry already does this on a regular basis.
In answer to the possibility of a breakage fee the latest allowed fees as posted on the state website indicate that this is not allowed.
The overall program review seems complete and to the point.

b. Briefly describe the program's response to and intended incorporation of the ACT report recommendations.

The chemistry faculty will look at the various course prerequisites in catalog and schedule and reword as necessary. CHEM 192, 410 and 420 will be corrected as the new course outlines are prepared this semester.
Since glass breakage and materials fees are interrelated, the chemists will consider lower cost or unbreakable alternatives wherever possible to lower the everyday equipment cost.

Upon its completion, please email this Program Review and Planning report to the Vice President of Instruction, the appropriate division dean, and the CSM Academic Senate President.

Date of evaluation: March 25, 2010

Please list the department's Program Review and Planning report team:

Primary program contact person: Michael Clay
Phone and email address: 650 574-6604 clay@smccd.edu

Full-time faculty: Kate Deline, Jeff Flowers, Yin Mei Lawrence
Part-time faculty:
Administrators: Charlene Frontiera
Classified staff:
Students:

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Michael Clay March 25, 2010

Faculty's signatures *Date*

Charlene Frontiera March 25, 2010

Dean's signature *Date*