REVIEW REPORT

on the

CHEMISTRY PROGRAM

JULY, 2000

EXECUTIVE SUMMARY

The Chemistry Program Review Committee commends the Chemistry faculty on their dedication and group cohesiveness, which has resulted in a strong Chemistry Program at UCC.

Lack of funds to purchase new equipment and maintain and repair existing equipment was identified by faculty as a major problem area. The Committee agrees with the Chemistry faculty that the annual capital budget allocation of $10,000 for equipment replacement is insufficient. This problem can be lessened, in the opinion of the committee, through the developing of an institutional policy for purchase and replacement of capital equipment. Such policy must take into account the life expectancy of the equipment from the onset and allocate the necessary funds on an annual basis for maintenance, repair and eventual replacement.

While the Committee applauds the Chemistry Program's academic strengths, as illustrated by the many successes of its graduates, it makes some suggestions in the area of curriculum to improve the program. These recommendations include increasing the statistics content for Chemistry Majors, adding exposure to quantum mechanics and refocusing the content in some courses.

The Chemistry faculty acknowledge that although not ideal, Library holdings and on-line services are adequate for their program. The Committee perceives a spirit of cooperation between the Chemistry Faculty and the Library and encourages their collaboration to fully utilize all resources available such as the Degree Grant.

While the Committee acknowledges the validity of concerns expressed by students regarding the accuracy, consistency and reliability of advice given by Academic Advising, it also concludes that some of the blame is shared between the students and transfer destination universities. Several recommendations are made to improve the communication and reliability of information among the Academic Advisors, students and faculty.

Lastly, the lack of opportunities for student summer employment in research was identified as a problem by faculty and students The Committee agrees that the lack of practical experience for students is an impediment to the continuing success of UCC's Chemistry's graduates. Therefore, the Committee recommends that steps be taken by the institution to improve the availability of summer research employment opportunities for students.

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COMMITTEE MEMBERS

CHAIR	Bernie Kirkey Accounting and Computing Science, UCC
ASSISTANT CHAIR	Dr. Ron Smith Biological Sciences, UCC
EXTERNAL REPRESENTATIVE	Dr. Ross Hill Professor, Chemistry, Simon Fraser University
RESOURCE PERSON	Dr. Doug Bickley Chair, Physical Sciences and Engineering, UCC
DEAN	Dr. Colin James Dean, Sciences, UCC
REVIEW COORDINATORS	Dr. Alastair Watt Director, Institutional Research and Planning, UCC Dorys Crespin-Mueller, Research Analyst Research Analyst, Institutional Research and Planning, UCC

Program Background

When Cariboo College opened in 1970, the Chemistry faculty consisted of two instructors and a lab. demonstrator. Courses taught in the first year were CHEM 110/120 and CHEM 111/121 (the university transfer courses in general chemistry), and CHEM 113/123, which was intended for pre-nursing and BCIT Medical Laboratory transfer students. Also offered was a short-lived Materials Science course for Wood Products and MiningTechnology students intending to transfer to BCIT.

In the second year of operation, Physical and Inorganic Chemistry (CHEM 211/221) and Organic Chemistry (CHEM 212/222) courses were added. Further courses were developed when a Medical Laboratory Technology program was established at Cariboo in 1972, and later when the Respiratory Therapy and Animal Health Technology programs were offered. For a time, the upgrading courses CHEM 050/060 were taught by Chemistry faculty, but these later became the responsibility of the College Preparation Department.

In 1988/89, planning began for upper-level programming to be offered in the newly established University College of the Cariboo under UBC's sponsorship. Four additional hirings took place, essentially doubling the Chemistry faculty.

In 1990, the Department of Science was divided into two departments – Biological Sciences and Physical Sciences and Engineering, the latter encompassing Chemistry, Physics and Geology. Majors in Chemistry and Environmental Chemistry were developed under the auspices of UBC. To coincide with UCC offering its own degrees, a new UCC Chemistry major was launched in 1996, followed by a re-designed Environmental Chemistry major in 1997. In September, 1998, Co-Operative options were introduced into the two majors.

In 1998-99, UCC Chemistry underwent the accreditation process of the Canadian Society for Chemistry, and both major degrees received full accreditation in July, 1999, for the period 1999-2004. The UCC Chemistry majors are the first accredited BC university college Chemistry programs.

CHRONOLOGY OF PROGRAM REVIEW

The Chemistry Program Review was launched on September 28, 1999, with a meeting between the Office of Institutional Research and members of the Chemistry discipline to discuss the focus and process of the review. Subsequent to this meeting, a Chemistry Program Steering Committee was struck, consisting of Doug Bickley, Sharon Brewer, Jim Davies and Norman Reed. By January 17, 2000, this committee had finalized the questionnaire design and identified the constituencies it wished to survey.

Stakeholders in the Chemistry Program were surveyed on the following dates:

Former Students (1996-99):	January 27, 2000
Faculty:	January 27, 2000
Current Students (2nd Year):	February 27-March 1, 2000
Current Students (Yrs. 3, 4):	March 1-6, 2000

In addition, five years (1995-99) of data on UCC Chemistry majors were obtained from the BC Colleges and Institutes Student Outcomes Surveys via the Student Outcomes Reporting System (SORS).

Reminders were mailed to non-responding former students on February 15, 2000. All faculty had responded by February 17. The Office of Institutional Research attempted to contact non-responding students by phone between March 2 and 6.

The cut-off date for all responses was March 28. Information binders were sent to members of the Chemistry Program Review Committee on April 3, and that committee met to analyze the data and form its recommendations on April 27 and 28, 2000.

PROGRAM REQUIREMENTS

Major in Chemistry

First and Second Years	
CHEM 110/120 or 111/121	6 credits
one of: BIOL 110 or 120	
BIOL 111 or 121	3 credits
GEOL 111 or 205	
COMP 100	3 credits
ENGL 110 or 111	3 credits
(or two of ENGL 110, 111 and 121)	(6 credits)
MATH 113/123 or 114/124 or 115/125	6 credits
PHYS 110/120 or 115/125	6 credits
CHEM 212/222	6 credits
CHEM 215/225	6 credits
MATH 211/212	6 credits
ENGL 229 or 230	3 credits
Electives	9-12 credits

Third and Fourth Years	
CHEM 306	3 credits
CHEM 307	3 credits
CHEM 308L	1 credit
CHEM 310	3 credits
CHEM 312L	1 credit
CHEM 314	3 credits
CHEM 322	3 credits
CHEM 323	3 credits
CHEM 324L	1 credit
CHEM 331	3 credits
CHEM 332	3 credits
CHEM 333L	1 credit
CHEM 440L	1 credit

Major in Environmental Chemistry

First and Second Years	
one of: BIOL 110/120 or 111/121	6 credits
one of: CHEM 110/120 or 111/121	6 credits
COMP 100	3 credits
ENGL 110 or 111	3 credits
(or two of ENGL 110, 111 and 121)	(6 credits)
MATH 113/123 or 114/124 or 115/125	6 credits
PHYS 110/120 or 115/125	6 credits
CHEM 212/222	6 credits
CHEM 215/225	6 credits
ENGL 229 or 230	3 credits

GEOG 122	3 credits
MATH 211	3 credits
STATS 200 or BIOG 300	3 credits
Electives	3 – 6 credits

Third and Fourth Years	
CHEM 301	3 credits
CHEM 302	3 credits
CHEM 306	3 credits
CHEM 307	3 credits
CHEM 308L	1 credit
CHEM 310	3 credits
CHEM 312L	1 credit
CHEM 314	3 credits
CHEM 322	3 credits
CHEM 323	3 credits
CHEM 324L	1 credit
CHEM 331	3 credits
CHEM 332	3 credits
CHEM 333L	1 credit
CHEM 440L	1 credit

B.Sc. Co-operative Education Degree Program

Chemistry Options: Applicants must have maintained a B average (minimum) in Chemistry courses and must maintain a cumulative GPA of 2.67 (minimum) in all B.Sc. degree courses. Students must complete 3 Co-op work terms to graduate with Co-op Designation on their transcripts. Chemistry students normally apply in the Fall semester of their third year.

TABULAR SUMMARY OF QUESTIONNAIRE RESPONSES
CHEMISTRY PROGRAM REVIEW

Recipient	# Sent	# Completed & Returned	% Returned
Faculty	14	14	**100%**
Students:			
Current– Year 2	86	86	**100%**
Current – Years 3/4	14	14	**100%**
Former	54	33	**61%**
SORS Data (BC College & Institutes Student Outcomes Data 1995-1999)	38	27	**71%**
TOTAL	**206**	**174**	**84%**

SUMMARY OF QUESTIONNAIRE RESPONSES

Student Responses

The questionnaire responses of the former, 2nd year and upper level students were very consistent. Therefore, the summaries of their responses have been pooled.

Admissions and Advising: A significant proportion of students (12-35%) sense that 1st and 2nd year advising is unsatisfactory. Not many specifics were referred to. Some students were concerned with the information they received, whereas others were concerned by the length of time it took to see an Advisor after making an appointment. The faculty advisor and the Chemistry faculty were praised for their helpfulness in advising upper level students.

Structure and Curriculum: The students would appreciate more course selection within Chemistry. Second year students generally question the relatively small proportion of the grade they receive for their lab work related to the effort they put into labs. Further, the students want to evaluate more of the courses in which they are enrolled.

Learning Process: Many of the students commented that the workload in Chemistry was higher than in other disciplines and took pride in this.

Resources: The students would appreciate more Library resources, especially journals and were concerned with the time it took to receive interlibrary loans.

Faculty Resources: The students found the faculty extremely helpful and well qualified. Their feelings can be summed up by one student's comment "the faculty MADE the UCC program". The students were concerned, however, by the limitations of the relatively few Chemists on staff and the "qualifications of some part-time Lab Instructors".

Student Skills and Abilities: The students would value more statistics in the Chemistry Major.

Strengths: The students overwhelmingly commented that Chemistry is an excellent program because of its excellent faculty and the small student/faculty ratios of its classes.

Availability of Practical Research Experience: The vast majority of students feel it is extremely important to hold summer jobs that give them some practical research experience in preparation for employment or further education pursuits.

Limitations: Besides the limitations referred to above, the students recognize the need to be exposed to modern equipment and recognize the limitations imposed by the current repair budget in Chemistry.

Faculty Responses

Objectives of the Program: Of the 14 faculty respondents, two members were not clear about the goals and objectives of the Program.

Admissions and Advising: One individual commented that students should require a prerequisite grade of C+ to enter into Chemistry courses. The vast majority of responses, however, indicated that the current standards are adequate given that the Registrar's Office check the prerequisites of all students, especially those in 1st year.

Resources: The Chemists sense that the resources they require to support their teaching (library resources, lab supplies, PD funds) and scholarly activity pursuits (research and PD funds, time and space) are generally inadequate.

Faculty Resources: The questionnaire responses indicate that there are sufficient faculty to maintain the Chemistry Program but more continuing full-time faculty would be needed to enhance or increase the program. The respondents also suggest that the Chair does not have sufficient release to conduct the administrative duties required of the position.

Articulation and Liaison: Communication within the Chemistry group seems productive with some concern raised between the communication between Chemists from the Williams Lake campus. The adequacy of communication between the Chemists and the Divisional Dean, in general and at Divisional meetings, scored low in the survey. There was also some sense that the Chemists could use more secretarial support.

Strengths: The Chemists indicated that the strengths of their program include the highly qualified and dedicated faculty in the program. As well, they sense that their ability to work as a cohesive group and the maintenance of small class sizes has contributed to the many successes of the Chemistry Program.

Limitations: The major limitation identified in the questionnaire was the lack of funds available to purchase new equipment and maintain and repair existing equipment. Other limitations identified include the lack of prerequisite checking by the Registrar's Office, lack of Chemistry courses and lack of space.

Concerns: Several survey respondents expressed their concern over how a potential reduction in 1st year registrants will affect the number of students progressing into the subsequent years of the Chemistry Program.

STRENGTHS OF THE PROGRAM

From the Review material it is quite apparent that the members of the Chemistry Program are highly qualified and dedicated. These traits, coupled with the extreme cohesiveness of the group, have led to the development of a very strong Chemistry Program at UCC over the past 30 years. Further evidence of the strength of the Chemistry Program comes from the recent accreditation of the two Major degrees in Chemistry from the Canadian Society for Chemistry (CSC) and the nomination of the Chemistry group for the Natural Sciences and Engineering Research Council of Canada (NSERC) 2000 Michael Smith Award for the promotion of Science. Specific accomplishments of the Chemistry group follow.

Development of the Chemistry Program:

Chemistry started as a two-year transfer program at UCC in 1970. Since that time the members in Chemistry have been instrumental in developing a Chemistry Major, followed by an Environmental Chemistry Major. Both Majors having recently been accredited by the CSC. The accreditation of these programs was no small feat given the limited faculty resources available. The Review Committee had the sense that the inclusion of the 400-level special topic module courses was very useful in increasing the comprehensiveness of the Chemistry degrees. It should be noted as well that the Chemists (most notably Dr. John McIntosh) contributed to the design of the central portion and wings of the Science Building.

Chemistry Co-Op:

Graduates in Chemistry, and those of other disciplines as well, are more successful in their post-graduate pursuits having related extra-curricular experience. As such, the Review Committee commends the Chemistry Program for introducing a Co-Op Option into its degree programs. It is apparent from the questionnaires that Chemistry students feel likewise.

Public Relations:

The whole of the Chemistry faculty work well beyond the Collective Agreement to promote Chemistry in the Kamloops region. The Chemists are, as a group, energetic participants in the annual Science Night festivities, the regional Science Fair and Chemistry week displays in the community. Outside of these professional duties the Chemists also conduct promotional Chemistry "magic shows" in the schools in the region, hold an annual high school Chemistry contest and have regularly hosted conferences attended by Chemists from as far away as Ontario. Within UCC, the Chemists sponsor the Chemistry/Biochemistry Club, which has taken on the responsibility for hosting the Erlenmeyer Cup and Brew Off, two very successful student-faculty gatherings. The sum of the above activities has undoubtedly led to proportionately large Chemistry class sizes at UCC as compared to the enrollments in most other North American Chemistry programs.

Student Success:

Students graduating from the Chemistry Program at UCC are very successful. They have gained entry in professional programs such as medicine, veterinary medicine, teaching and graduate schools across North America (a substantial number with NSERC Scholarships) and have been employed directly in fields related to their areas of study. The success of the students is a direct function of the low student to faculty ratio in Chemistry courses, especially in the upper level courses, and the mentoring the faculty give the students in the field of Chemistry and in the development of written and oral communication skills. The students are grateful for the assistance they received during their degree programs and often come back to visit and even feel comfortable addressing the attendees of retirement parties.

Potential Research Park:

The Chemistry Program has the potential to benefit from the development of a Research Park at UCC.

AREAS OF CHEMISTRY WHICH CAN BE IMPROVED (WITH RECOMMENDATIONS)

Through interviews and examination of the data, the Review Committee identified the following main areas for improvement in the Chemistry Program: operating capital; curriculum; library usage; program administration; and student summer employment.

1. OPERATING CAPITAL

Two areas of concern brought to the attention of the Review Committee were the overall age and condition of the instrumentation in the Chemistry labs and the lack of an adequate mechanism for funding the maintenance, repair, and replacement of existing lab equipment, much less the acquisition of any new equipment. The capital budget allocation for Chemistry is usually around $10,000 per year. This is sufficient for purchase or replacement of moderately priced items of equipment, but not for major purchases. The situation is aggravated by the age of some of the major equipment items: four of the five spectroscopes and one of the two gas chromatographs are 26 years old. The instruments have been repaired numerous times over the years, but because of their age are in constant danger of terminal breakdown. In at least one recent instance, a significant 9-year old instrument (nmr), which was purchased using initial degree capital funding, was rendered out-of-service for several months spanning two academic years while funds ($38,000) were being located for its repair. Despite the fact that repairs to this essential equipment was inevitable, courses were forced to operate without it for a substantial period of time.

The committee noted that the current operating budget allocation of $3,000 for equipment maintenance is clearly inadequate. In addition, a $1,000 threshold for expenditures to be classified as capital as opposed to operating in nature, thereby requiring separate, annual budget allocation appears to be outdated given the current costs of equipment maintenance and repair in this field. The combination of these policies necessitates a crisis management approach to equipment maintenance and has a very real adverse impact on courses and students' learning experiences in the Chemistry Program.

The Committee feels that institutional recognition should be given to the imminent necessity of replacing equipment that may cost well over $100,000, and that an annual capital budget allocation of $10,000 is obviously insufficient to cover this eventuality. A more realistic capital budget allocation would permit planning for acquisition of more modern equipment, thereby giving the students the benefit of experience with current technology in their courses rather than focus on older equipment.

The Committee also noted that the Chemistry Program has been fortunate in receiving some instrumentation donations from other area institutions. In light of the fact that the annual capital budget allocation for new equipment is minimal, and the donated equipment is functional and represents a cost saving to UCC, it is unfortunate that there is no operating budget capacity available to maintain or repair the equipment. Because of the age of the donated equipment, it is particularly subject to breakdown and subsequent removal from service because of lack of funds to expedite repairs.

The Committee recommends:

(a) **that the Vice-President, Administration and Finance, or his designate, develop an institutional policy for purchase and replacement of capital equipment, such a policy to account for expected useful life of equipment from the outset and allocate the necessary funds on an annual basis for its maintenance, repair, and eventual replacement;**

ACTION: Vice-President, Administration and Finance

(b) **that the Divisional Dean set up a five-year rolling plan for equipment replacement;**

ACTION: Dean, Sciences and Health Sciences

(c) **that the Divisional Dean and the Divisional Liaison Group review the criteria for allocation of operating capital within the Division and whether the amounts allocated to new equipment, replacement equipment and equipment repairs and maintenance are proportional and appropriate to pressure and demand in these areas across the Division;**

ACTION: Dean, Sciences and Health Sciences; Science Division Liaison Group

and

(d) **that the Dean and the Chemistry faculty explore and pursue opportunities to continue to attract equipment donations from organizations outside UCC.**

ACTION: Dean, Sciences and Health Sciences; Chemistry faculty.

2. CURRICULUM

The Committee reviewed the course outlines, calendar descriptions and survey response data on the Chemistry curriculum and offers the following suggestions to the Chemistry faculty:

Quantum Mechanics:

The external representative suggested that Chemistry majors would benefit from exposure to quantum mechanics. This change would allow for coverage of solid state chemistry in CHEM 331/332 (see below). The Committee concurred, and therefore recommends:

(a) **that Chemistry and Physics faculty explore the possibility of opening Physics 200 to Chemistry majors and possibly co-listing Physics 200 as a Chemistry course.**

ACTION: Chemistry and Physics faculty

Since Physics 200 has specific math pre-requisites, a corollary to this is

(b) **that Chemistry faculty review first year Math pre-requisites for Chemistry so that Chemistry students can take Physics 200.**

ACTION: Chemistry faculty

Statistics:

Former and current students indicated that a greater exposure to statistics would be desirable. The Committee determined that Biology 300 (Biometrics) is required for the Environmental Chemistry major, but not for Chemistry majors. CHEM 314 partially fulfills the requirement, but more statistics are needed. The Committee recommends:

(c.1) that Chemistry faculty integrate more statistics into upper level Chemistry laboratories;

or

(c.2) add Biology 300 to the Chemistry Major;

ACTION: Chemistry faculty

(d) that Chemistry faculty monitor these initiatives to see if they meet the demand for statistics.

ACTION: Chemistry faculty

The external representative also noted a lack of modern physical chemistry and lab techniques. He made recommendations in the following areas with which the Committee concurred:

Physical Chemistry:

(e) that in addition to the equilibrium thermodynamics covered in their Physical Chemistry courses, the Chemistry faculty consider adding such topics as non-equilibrium thermodynamics, surface chemistry, reaction dynamics, and statistical mechanics to the curriculum;

ACTION: Chemistry faculty

(f) that the Chemistry faculty explore the possibility of including modern experiments using instrumentation such as spin-echo, scanning tunneling microscopy, and laser-based experiments to give students an appreciation of modern research.

ACTION: Chemistry faculty

Analytical Chemistry:

To enable students to be more competitive in the market for summer and co-op positions, the Committee recommends:

(g.1) that the Chemistry faculty develop a 2nd year analytical/environmental course.

or

(g.2) that the Chemistry faculty modify the existing CHEM 215 and CHEM 225 to reflect the analytical component of these courses. This might involve simply renaming the courses.

ACTION: Chemistry faculty

CHEM 110/120 and CHEM 111/121:

(h) that the Chemistry consider faculty re-titling CHEM 110/120 and CHEM 111/121 in a manner which better differentiates them, and dropping the "(Enriched)" qualifier from CHEM 111/121.

ACTION: Chemistry faculty

Electives:

(i) that the B.Sc. Advisor ensure that PHIL112 (Understanding Scientific Reasoning) and 433 (Biomedical Ethics) are brought to the attention of Chemistry majors as electives.

ACTION: B.Sc. Advisor

General:

The Committee noted that some graduating students might have had exposure to only one instructor in organic chemistry throughout their studies at UCC. The Committee recommends:

(j) that the Chemistry faculty explore opportunities to involve more than one instructor in each topic area, where possible, in order to expose students to varying approaches to and a wider perspective on the topic.

ACTION: Chemistry faculty

(k) that the Chemistry faculty and the Dean, Sciences and Health Sciences explore opportunities to involve the Dean as an instructor.

ACTION: Chemistry faculty; Dean, Sciences and Health Sciences

3. LIBRARY USAGE

Although some former and current students complained about the adequacy of the UCC Library, and particularly its journal holdings in Chemistry, relations between the Chemistry faculty and the Library appear to be cordial, with faculty acknowledging that while by no means ideal, Library holdings and on-line services are adequate for an undergraduate Chemistry program. The Committee was informed that because up to 50% of each department's library allocation from the Degree Grant may as of this year be applied to journal purchases, serial holdings may be augmented. It applauds this initiative, and recommends:

(a) that the Director, Library and Information Systems, continue to work with instructional departments on the proportion of each department's library budget that can be spent on journals (this year, up to 50%);

ACTION: Director, Library and Information Systems

and

(b) that Chemistry faculty avail themselves of this portion of Degree Grant money to enlarge Chemistry serial holdings.

ACTION: Chemistry faculty

The Committee also note some comments by 2nd and 3rd year students to the effect that little was being done in training them to access electronic databases and on-line serials and abstracts. It therefore recommends:

(c) **that Chemistry faculty implement an introductory library component, at 1st year and 2nd year level so that students entering upper level courses are practiced in on-line access of journals and databases.**

ACTION: Chemistry faculty

4. PROGRAM ADMINISTRATION

Academic Advising:

Student and former student ratings of and comments on academic advising suggested some frustration with the accessibility of the Academic Advisors and the accuracy, consistency and reliability of advice given by them. Interviews with the Co-ordinator, Academic Advising, and the B.Sc. Advisor revealed that while inaccurate advice is occasionally given, some of the blame can be attributed to the students themselves and to the transfer destination universities. For example, some 1st year students lack the focus and direction to make academic career choices; at 2nd year level, some change their minds, necessitating back-tracking to pick up missed pre-requisites. The BC universities are likewise notorious for changing program requirements at short or no notice, leaving would-be transfer students without the necessary prerequisites. Finally, the demand for service—12,000 contacts in 1999-2000, and 8,000 interviews carried out by a staff of 4.5 Academic Advisors—means that there is simply not enough time for each individual student, and that mistakes in communication will be made.

The Committee sympathizes with the Academic Advisors, and recommends:

(a) **that the Academic Advising Department institute a policy of requiring students' attendance at a group advising session before they can make individual appointments;**

ACTION: Academic Advising Department

(b) **that Academic Advisors should continue to stress the potential problems students might encounter in subsequent program and course selection and the relative importance of careful course selection in 1st and 2nd year;**

ACTION: Academic Advising Department

(c) **that UCC instructional departments be responsible for advising the Academic Advising Department of relevant changes in both UCC programs and those of transfer destination universities as soon as they become known;**

ACTION: Committee of Chairpersons

(d.1) **that a consistent, formal means of communicating program and course changes that do not follow the established institutional policy of 14-months lead time for such changes be implemented;**

and/or

(d.2) **that instructional departments and Academic Advisors initiate meetings on a regular basis to update the Academic Advising Department on changes in program structure, prerequisites and transfer arrangements.**

ACTION: Committee of Chairpersons Academic; Advising Department

Admissions:

Faculty expressed concerns regarding the lack of prerequisite checking prior to student registration combined with the potential for reduction of overall 1st year enrollments at UCC. Together with the 1st year rate of attrition, this could have a serious impact on enrollment in upper level courses.

The Committee recommends:

(e) **that the Registrar's Office verify incoming students' prerequisites to the extent possible.**

ACTION: Registrar's Office

(f) **that Chemistry faculty monitor attrition rates with a view to possible future adjustments to course prerequisites.**

ACTION: Chemistry faculty

Monitoring of Grade Distributions:

The Committee noted that in some courses, grades appeared to be generous. The Committee recommends, as a general principle, and as a means of ensuring equitable grading within programs,

(g) **that the Divisional Dean ensure that chairpersons monitor departmental grade distributions each semester.**

ACTION: Dean, Sciences and Health Sciences

Formative Evaluations:

The Committee noted that some students thought that they were not being afforded sufficient opportunities to evaluate their courses and instructors. This function may be carried out by means of formative evaluations of instructors, which should be performed as per the Faculty Collective Agreement. The Committee recommends:

(h) **that the Chair, Physical Sciences/Engineering ensure that formative evaluations are carried out on a regular basis as per the Faculty Collective Agreement.**

ACTION: Chair, Physical Sciences/Engineering Department

Chair Workload:

The Committee noted that some faculty expressed concern over a lack of sufficient time release for the Chairperson to perform required duties. In light of our inability to assess the validity of that claim, the Committee recommends:

(i) **that the Chair, Physical Sciences/Engineering and the Dean, Sciences and Health Sciences undertake an assessment of the duties of the Chair with a view to possible reallocation, to ensure that departmental administrative tasks can be reasonably performed within the time available. Such reallocation might involve an increased level of secretarial support for the department.**

ACTION: Chair, Physical Sciences/Engineering Department

5. STUDENT SUMMER EMPLOYMENT

An important aspect of the educational opportunities in many undergraduate programs, including Chemistry, is the availability of student summer employment in research labs. The Committee was advised by Chemistry faculty that the current situation at UCC involving the CUPE requirement that summer students in research assistant positions be paid according to the CUPE wage scale has severely restricted these opportunities. In addition to the impact the onerous wage requirement has on the research budget, it should be noted that research funding organizations such as NSERC express concerns regarding funding of positions at those wages.

Given the Chemistry Department's stated objective of providing B.Sc. Chemistry major students with the practical skills necessary for employment and the demonstrated importance of this opportunity, the Committee recommends:

(a) **that the UCC Executive and the Director, Human Resources take steps to eliminate this impediment to the success of UCC graduates and to the continued high standing of the UCC Chemistry Program.**

ACTION: UCC Executive; Director, Human Resources

APPENDIX A
METHODOLOGY

The data were collected in the following ways:

1) Consultation took place with the Chemistry Program Review Steering Committee, consisting of consisting of Dr. Doug Bickley, Chairperson Physical Sciences and Engineering, Dr. Sharon Brewer, Dr. Jim Davies and Dr.Norman Reed on the design of the questionnaires.

2) Questionnaires were administered to Chemistry Program faculty, current students and former students. All data were processed using SPSS to achieve frequency rates and means. Subjective comments for each group were recorded separately and anonymously. Additional former student data from 1995-1999 program leavers were extracted from the Student Outcomes Reporting System (SORS), a software reporting tool summarizing data from the BC Colleges and Institutes Student Outcomes Surveys.

3) "Descriptive Data" on the Chemistry Program's objectives, course outlines, etc., were solicited from Dr. Bickley.

4) Data on annual seat utilization rates, graduation rates, gender and grade distributions were provided by the Office of Institutional Research and Planning.

5) The following people associated with the program participated in the review process or were interviewed:

Dr. Sharon Brewer, Chemistry
Bernie Crawford, Coordinator, Academic Advising
Dr. Maurice Granger, Chemistry
Trent Hammer, Lab Demonstrator, Chemistry
Nancy Levesque, Director, Library & Information Systems
Dr. John McIntosh, Chemistry
Dr. Onkar Rajora, Physics

SEAT UTILIZATION – FALL SEMESTER ONLY

The following takes into account the stable enrollment and capacity for the following semesters: fall 1997, fall 1998 and fall 1999.

Chemistry

Year	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (# of seats)	Total % utilization
1997	481	526	91%	102	133	77%	583	659	88%
1998	479	489	98%	93	163	57%	572	652	88%
1999	466	501	93%	109	142	77%	575	643	90%

Comparison with other Science disciplines for the same period:

Fall 1997

Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	481	526	91%	102	133	77%	583	659	88%
BIOLOGY	788	830	95%	235	236	100%	1023	1066	96%
PHYSICS	361	393	92%	34	47	72%	395	440	90%

Fall 1998

Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	479	489	98%	93	163	57%	572	652	88%
BIOLOGY	808	810	100%	261	311	84%	1069	1121	95%
PHYSICS	385	413	93%	33	50	66%	418	463	90%

Fall 1999

Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	466	501	93%	109	142	77%	575	643	90%
BIOLOGY	876	900	97%	270	308	88%	1146	1208	95%
PHYSICS	378	431	88%	18	44	41%	396	475	83%

1997/98 (Fall/Winter)

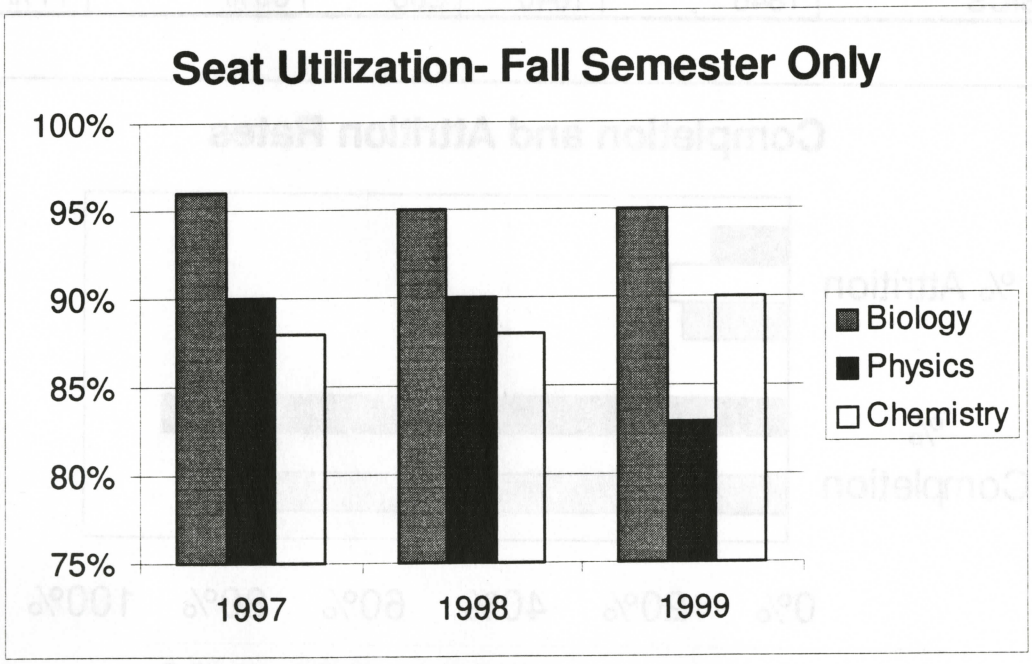
Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	873	987	88%	192	322	60%	1065	1309	81%
BIOLOGY	1459	1606	90%	511	533	96%	1970	2139	92%
PHYSICS	702	797	88%	55	73	75%	757	870	87%

1998/99 (Fall/Winter)

Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	849	910	93%	158	298	53%	1007	1208	83%
BIOLOGY	1517	1514	100%	507	578	88%	2024	2092	97%
PHYSICS	642	740	87%	51	82	62%	693	822	84%

1999/00 (Fall/Winter)

Discipline	Lower level enrollment	Lower level capacity (#of seats)	Lower level % utilization	Upper level enrollment	Upper level capacity (# of seats)	Upper level % utilization	Total enrollment	Total capacity (#of seats)	Total % utilization
CHEMISTRY	828	978	85%	196	288	68%	1024	1266	81%
BIOLOGY	1599	1773	90%	539	598	90%	2138	2371	90%
PHYSICS	691	819	84%	36	70	51%	727	889	82%



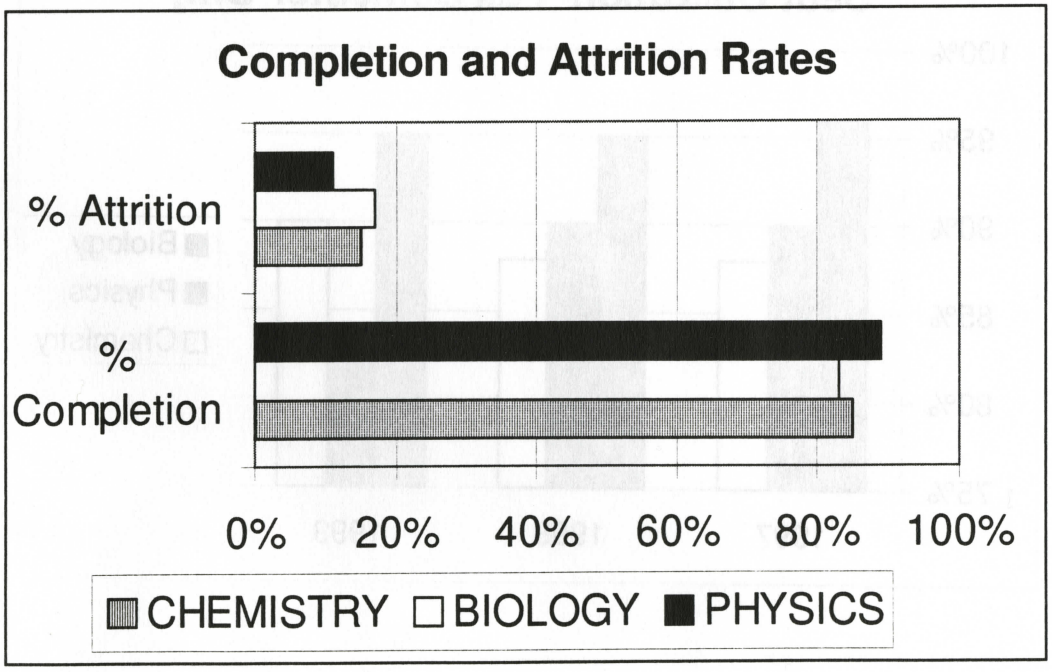
APPENDIX C
CHEMISTRY PROGRAM COMPLETION RATES

Completion rates may be determined by subtracting "fail" (F), "did not complete" (DNC), "withdrew" (W), "audit" (AUD) from enrollment numbers. Hence, over the period of Fall 1997, Winter 1998, Fall 1998, Winter 1999 and Fall 1999 the following completion and attrition rates are found:

	Total Registrants	Total Passes	Total Attrition	% Completion	% Attrition
1ST year courses	1572	1330	242	85%	15%
2nd year courses	616	491	125	80%	20%
3rd/4th year courses	459	419	40	91%	9%
Total	2647	2240	407	85%	15%

Completion rates compared to other Science disciplines:

Discipline	Total Registrants	Total Passes	Total Attrition	% Completion	% Attrition
CHEMISTRY	2647	2240	407	85%	15%
BIOLOGY	5140	4778	862	83%	17%
PHYSICS	1846	1640	206	89%	11%



APPENDIX D
GRADUATION HEADCOUNTS

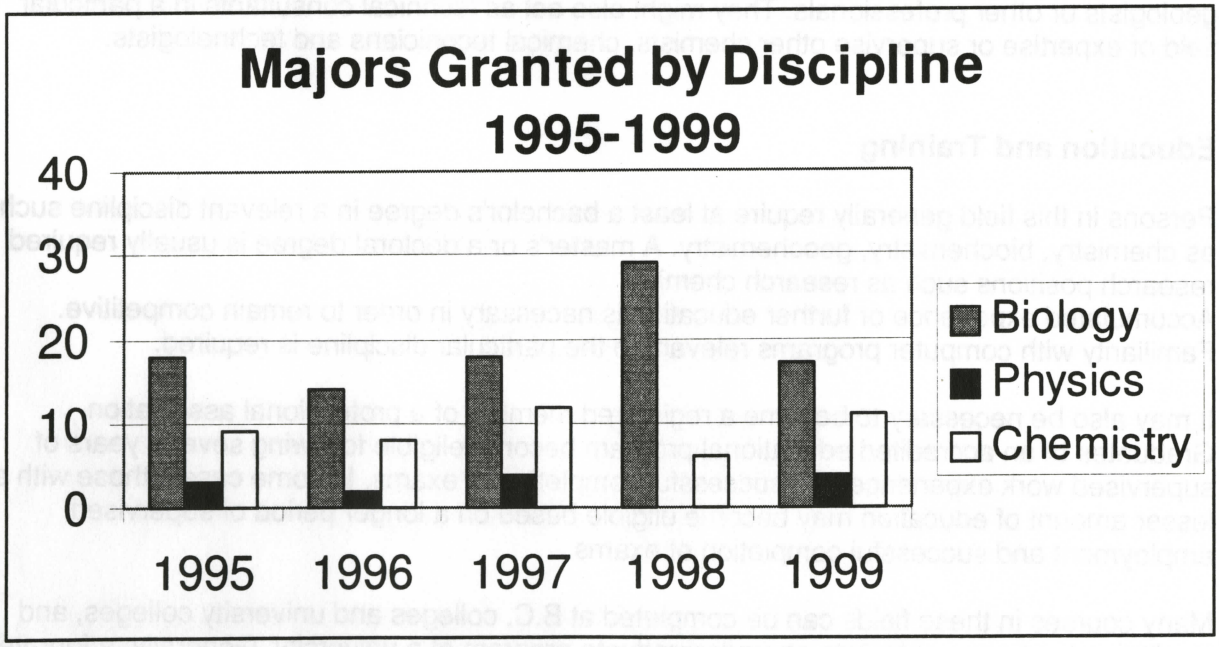
The following table reflects the number of graduating Chemistry Majors since 1995:

MAJOR	1995	1996	1997	1998	1999	TOTAL
CHEMISTRY	8	8	9	4	6	**35**
ENVIRONMENTAL CHEMISTRY	1		3	2	5	**11**
TOTAL	**9**	**8**	**12**	**6**	**11**	**46**

Graduation numbers from 1998 and 1999 reflect recipients of UCC degrees and UBC in conjunction with UCC degrees.

The following table reflects numbers of majors granted by discipline since 1995:

	1995	1996	1997	1998	1999	Total
CHEMISTRY	9	8	12	6	11	46
BIOLOGY	18	14	18	29	17	96
PHYSICS	3	2	4	0	4	13



APPENDIX E
EMPLOYMENT PROSPECTS[1]

Nature of the Work

Chemists conduct research and analysis in support of industrial operations, product and process development, quality control, environmental control, medical diagnosis and treatment, biotechnology and other applications. They also conduct theoretical, experimental and applied research into basic chemical and biochemical processes in order to create or synthesize new products and processes. Chemists are employed in research, development and quality control laboratories, in chemical, petrochemical and pharmaceutical industries, in mineral, metal, and pulp and paper industries and in a wide variety of manufacturing, utility, health, educational and government establishments.

This occupational group also includes metallurgists, soil scientists, and physical science occupations which are not elsewhere classified and involve the conduct of theoretical and applied research in fields of physical science. They are employed by governments, educational institutions and a wide range of industrial establishments.

Main Duties

Chemists analyse, synthesize, purify, modify and characterize chemical or biochemical compounds. They develop and conduct programs of analysis to ensure quality control of raw materials, chemical intermediates or final products, and they conduct programs of sample and data collection and analysis to identify and quantify environmental toxicants. They also conduct research to develop new chemical formulations and processes and devise new technical applications of industrial chemicals and compounds.

Further, they conduct fundamental and applied research into the synthesis and properties of chemical compounds and the mechanisms of chemical reactions, as well as investigate chemical aspects of the mechanism of drug action, the diagnosis and treatment of disease, organ function and the assessment of health. They participate in interdisciplinary research and development projects working with chemical engineers, biologists, microbiologists, agronomists, geologists or other professionals. They might also act as technical consultants in a particular field of expertise or supervise other chemists, chemical technicians and technologists.

Education and Training

Persons in this field generally require at least a bachelor's degree in a relevant discipline such as chemistry, biochemistry, geochemistry. A master's or a doctoral degree is usually required research positions such as research chemist.
Accumulated experience or further education is necessary in order to remain competitive. Familiarity with computer programs relevant to the particular discipline is required.

It may also be necessary to become a registered member of a professional association. Graduates of an accredited educational program become eligible following several years of supervised work experience and successful completion of exams. In some cases, those with a lesser amount of education may become eligible based on a longer period of supervised employment and successful completion of exams.

Many courses in these fields can be completed at B.C. colleges and university colleges, and credit received upon entry into an undergraduate program at a university. Generally, a four-year bachelor's degree is prerequisite for entry into graduate studies, which usually consists of a

[1] Source: BC Work Futures (NOC 211)

two-year master's program followed by a variable-length doctoral (Ph.D.) program. An Honours undergraduate degree may be required or recommended in order to enter a graduate program. Often in the physical sciences field, two disciplines are combined in the degree program. For example, a degree is obtained in physics and earth science, or in chemistry and oceanography. Further specialization can occur at the master's and doctoral level.

Working Conditions

Chemists usually work regular hours in offices and laboratories although they may do some of their research in a chemical plant or outdoors (for example, while gathering samples of pollutants). Chemists may work in small or large laboratories and the larger laboratories may incorporate prototype chemical manufacturing facilities as well as advanced equipment. There is a possibility that some chemists may be exposed to health or safety hazards in the handling of certain chemicals, but if proper procedures are followed, there is little risk.

In 1994, the average annual earnings for all workers in this occupational Group (Physical Science Professionals) were $45,600 with the 93% who worked full time for the full year receiving $57,300. The respective all-occupation averages were $28,700 and $39,800. The number of employed workers rose from 2,250 in 1990 to 2,820 in 1995. Nearly half (49%) of this group are geologists, geochemists or geophysicists, 31% are chemists and 10% are physicists or astronomers.

Self-employment for the entire group stands at 18%. By comparison, the rate of self-employment across all occupations in B.C. is 11%. It is higher among geologists, geochemists and geophysicists (30%), lower among chemists (3%) and non-existent among meteorologists. Only 7% of the entire group works part time compared to the B.C. all-occupation average of 22%.

The rate of unemployment for the entire group is about the same as the all-occupation average, but it is higher among geologists, geochemists and geophysicists, lower among physical science professionals such as metallurgists, soil scientists and materials scientists, and it is non-existent among physicists, astronomers and meteorologists.

Employment Prospects

Employment growth between 1995 and 2005 for professionals in the physical sciences is expected to be generally close to or slightly above the average for all occupations. Certainly scientists will be faced with government restraint in funding for research but technology is opening up many areas for development and industrial use. Any field that has commercial applications will see employment levels rise and receive private sector support.

Physicists and astronomers as well as chemists are expected to see a growth rate that is about as fast as the average. The occupational outlook is reasonably positive for chemists because of the growing importance being given to the environment, water quality, quality control, and occupational health and safety. Communication and information involving quality control in health and the environment along with national and international consultation are new areas that could create work for chemists. In addition, those who have acquired extensive experience can direct their careers toward leading projects with junior scientists and groups of technicians.

The expertise of chemists is also in demand in the area of chemical sales, where the complexity of products requires representatives who have extensive knowledge of chemistry. Specialists in pharmacology and toxicology are in demand in industrial pharmacy.

Analytical chemists will find more opportunities working on multidisciplinary teams (with usiness administrators, engineers, physicists, technicians and computer scientists). Progress in electronics and computers has caused their work to evolve from traditional chemistry to sophisticated chemistry using computer instruments. The use of robots, currently being introduced in analytical laboratories, will affect chemists who work with hazardous substances such as toxic products, solvents and radioactive material. Knowledge in programming these robots is becoming an asset.

Needs in the pharmaceutical industry are creating new research areas in hospitals, research institutes and companies. New technologies are helping clinical biochemists, particularly in the development and automation of immunological methods. A new range of simplified, miniature instruments makes it possible to provide the services of a clinical biochemist outside a traditional laboratory.

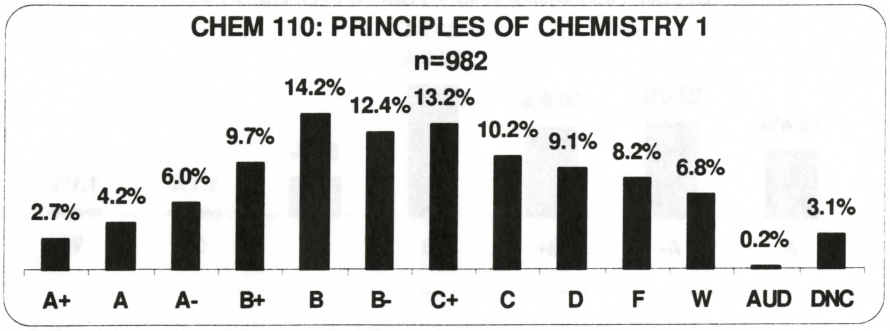
The outlook for chemists specializing in petrochemistry is not as optimistic because of a drop in activities in the petrochemical industries.

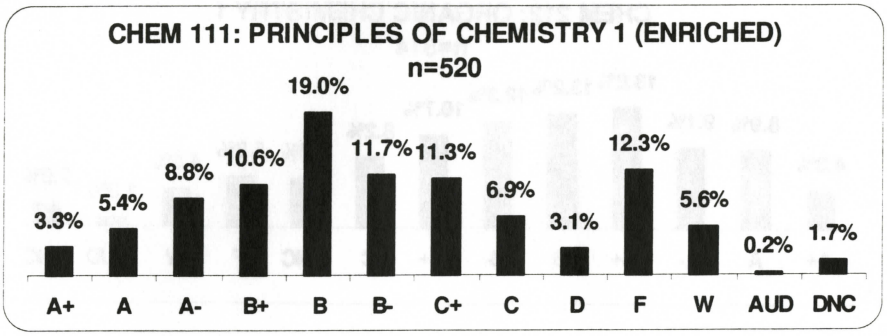
Trends and Projections

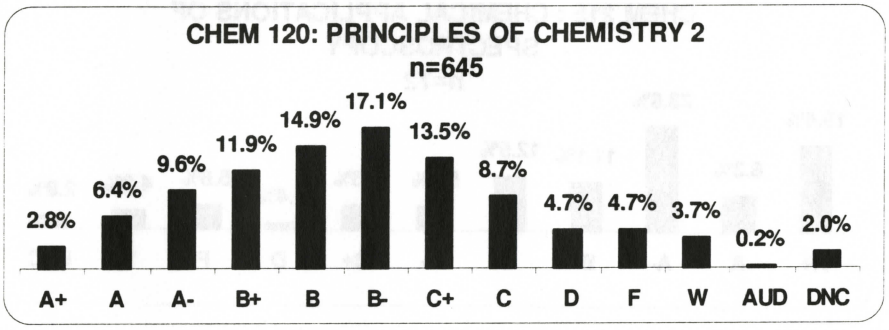
B.C. Employment Trends and Projected Demand

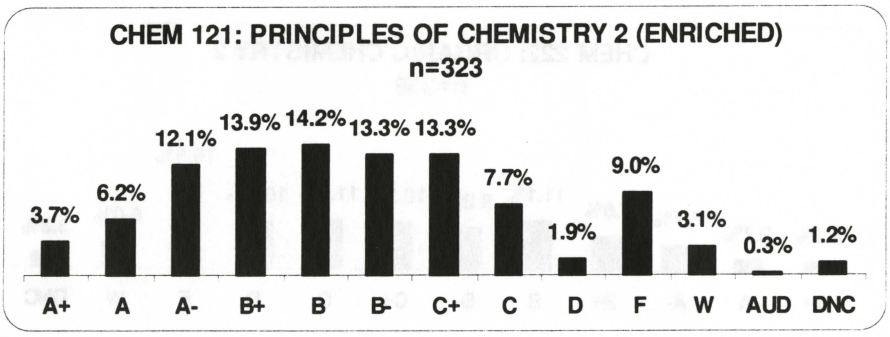
Number Employed	**1990** 2250	**1995** 2820	**2005** 3540
Estimated Openings 1995-2005	**Growth (Net)** 710	**Attrition** 590	**Total** 1300
Annual Growth 1995-2005	2.3%		
Main Industries of Employment			
Professional Business Services	30%		
Education	11%		
Federal Administration	11%		
Employment by Region			
Lower Mainland	62%		
Vancouver Island	23%		
Northern BC	5%		
Okanagan/Kootenay	11%		
Self-employment	18%		

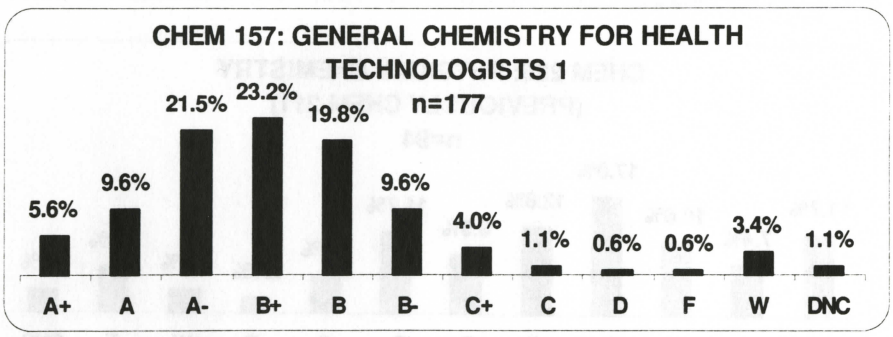
APPENDIX F
GRADE DISTRIBUTIONS: 95/FA – 99/FA[2] BY COURSE





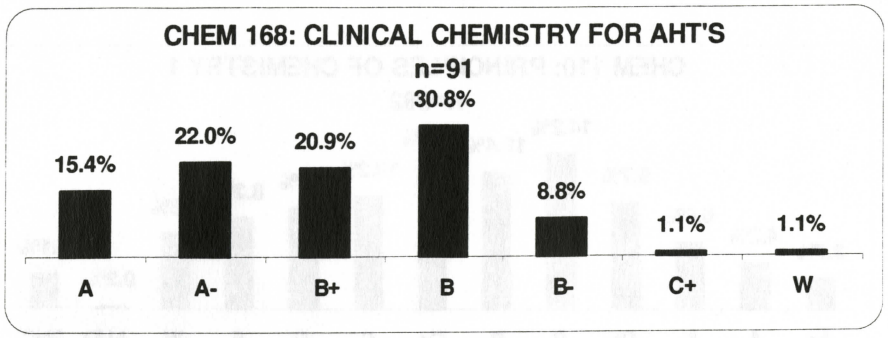


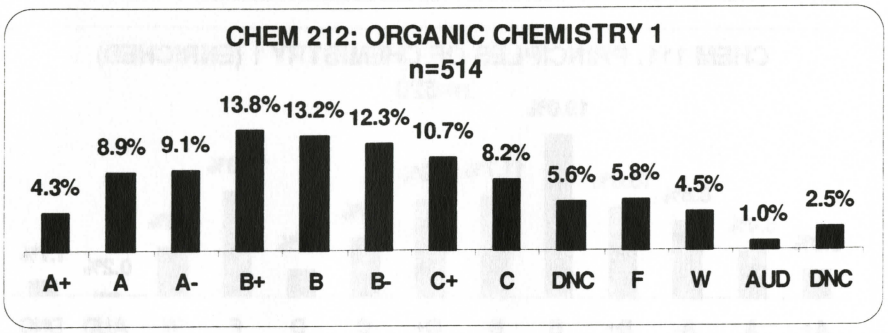


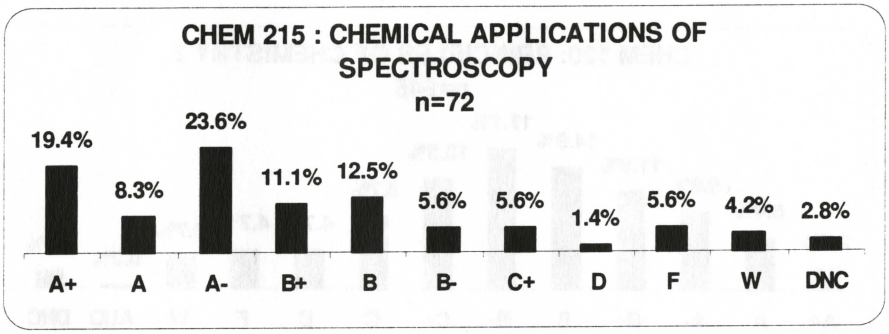


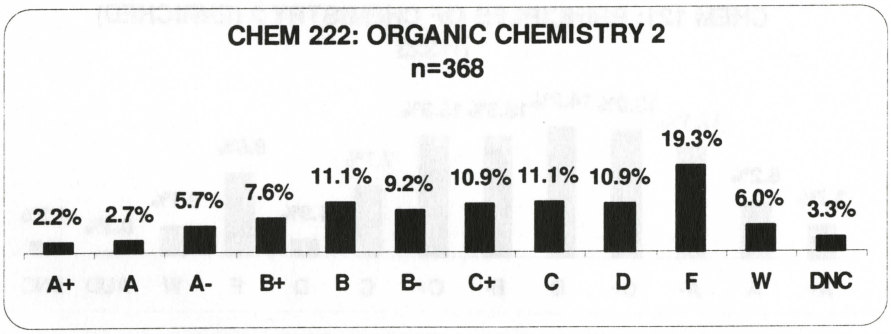
[2] Summer Session not included.

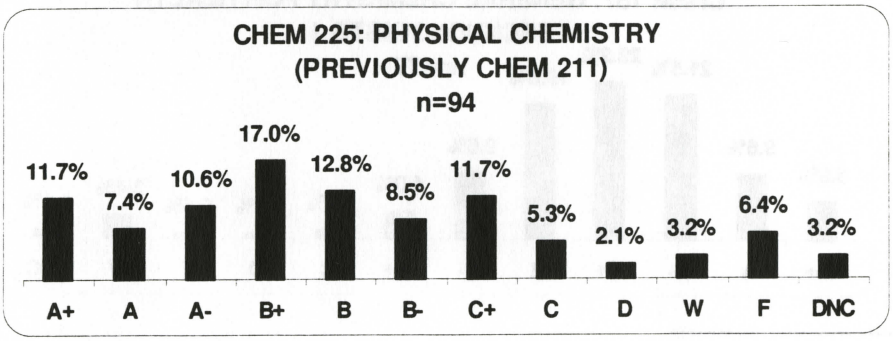
GRADE DISTRIBUTIONS: 95/FA – 99/FA BY COURSE











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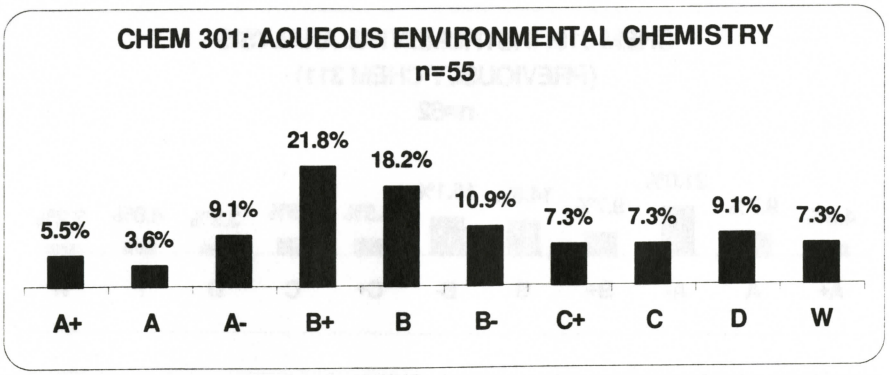

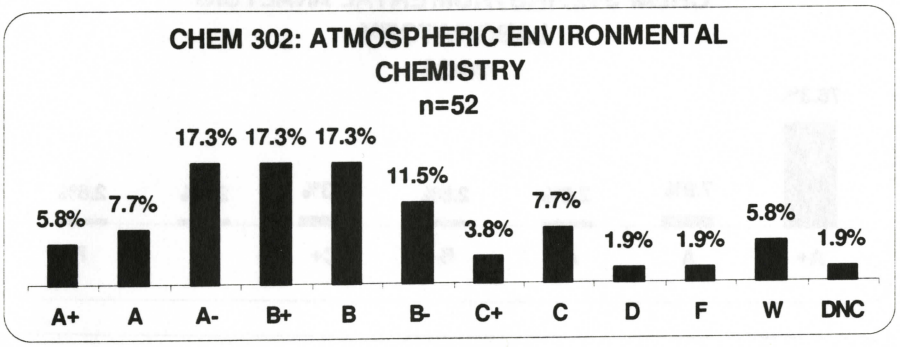

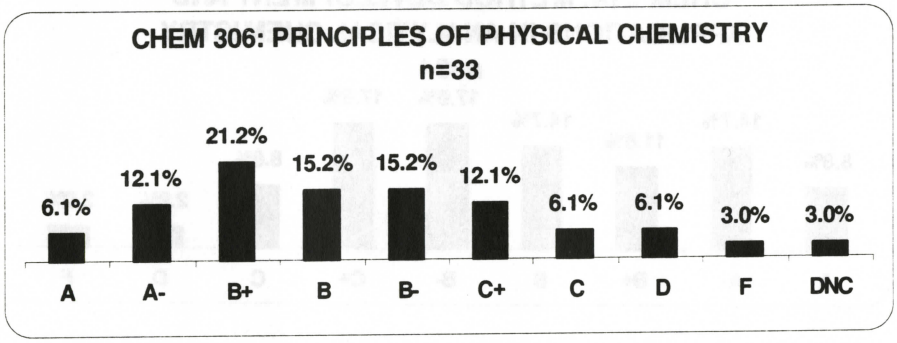

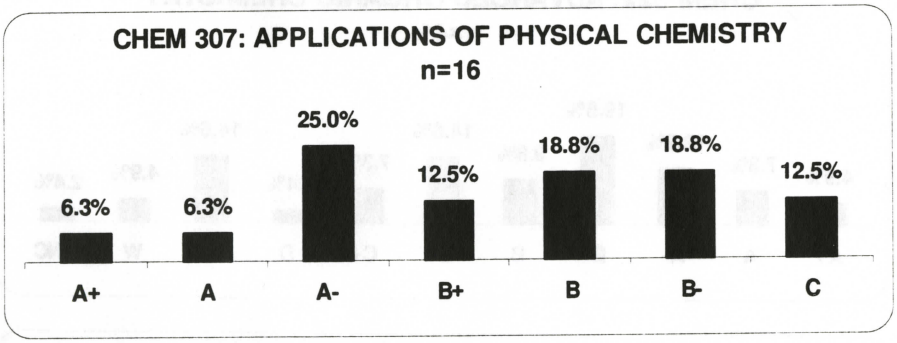

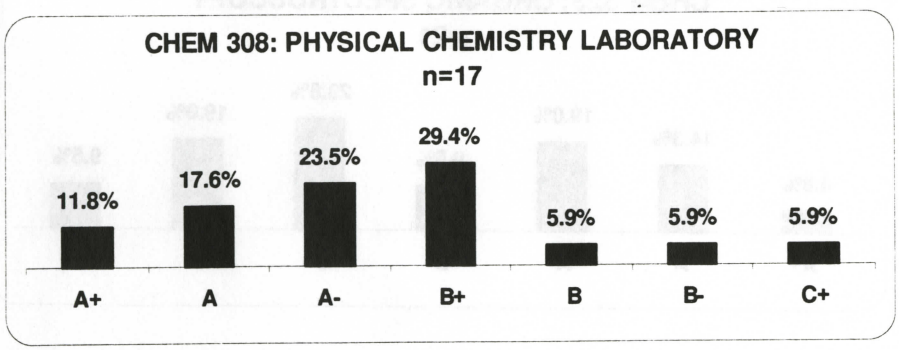

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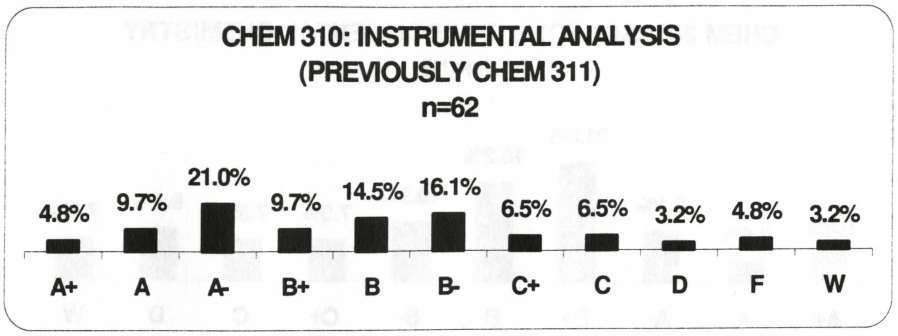

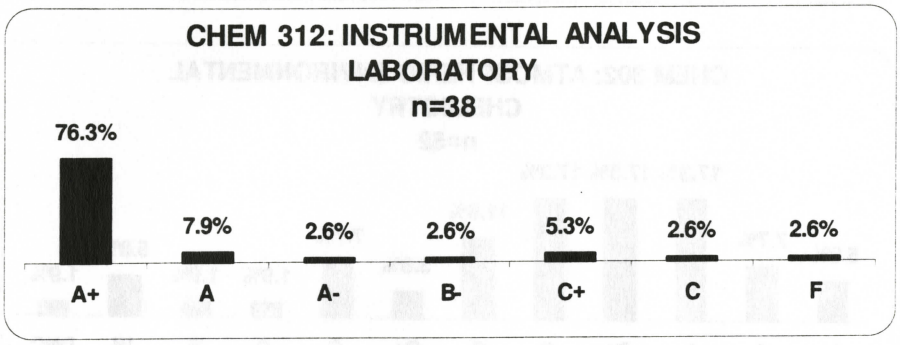

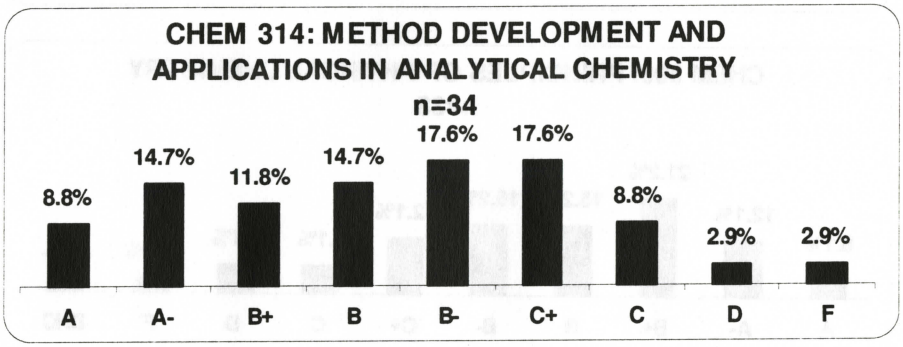

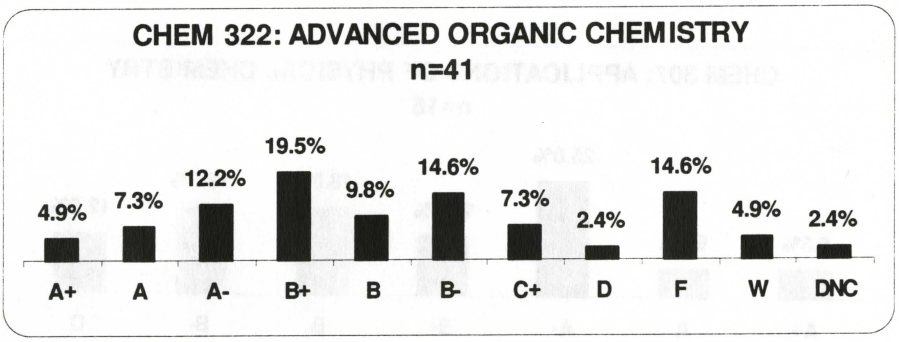

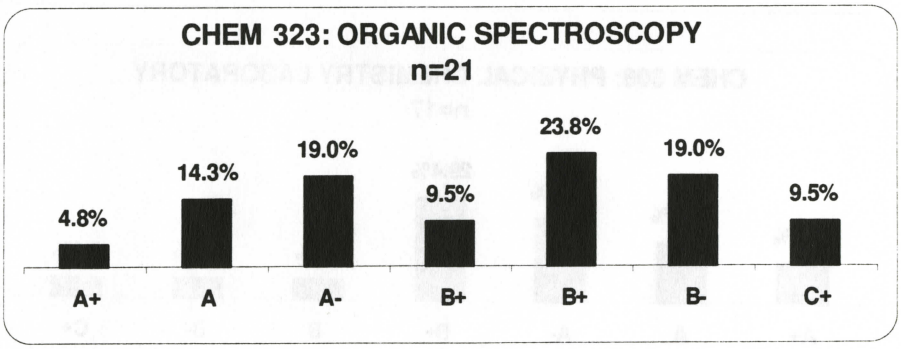

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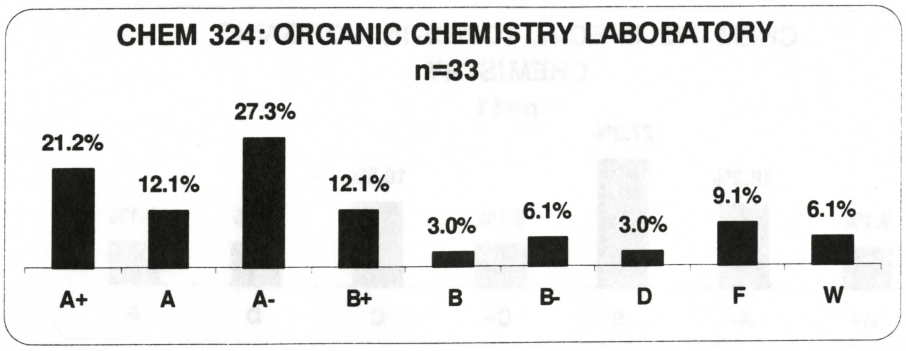

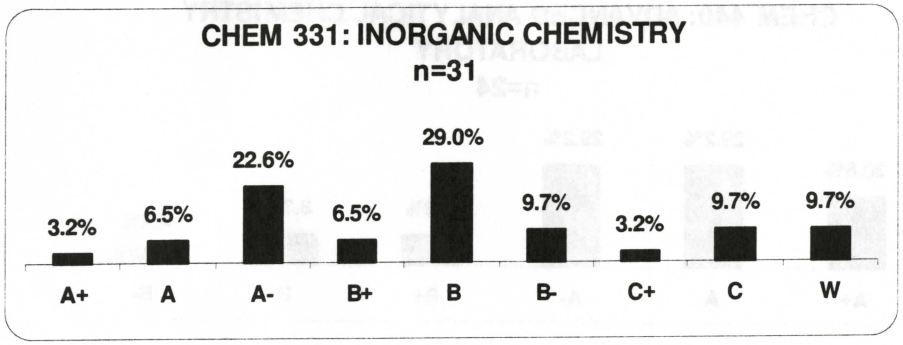

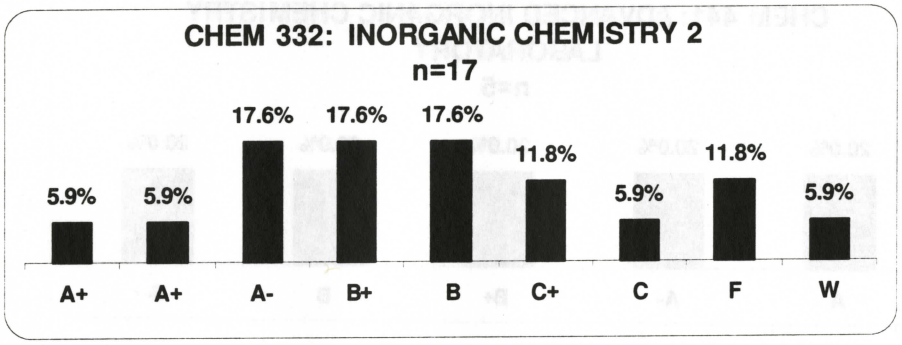

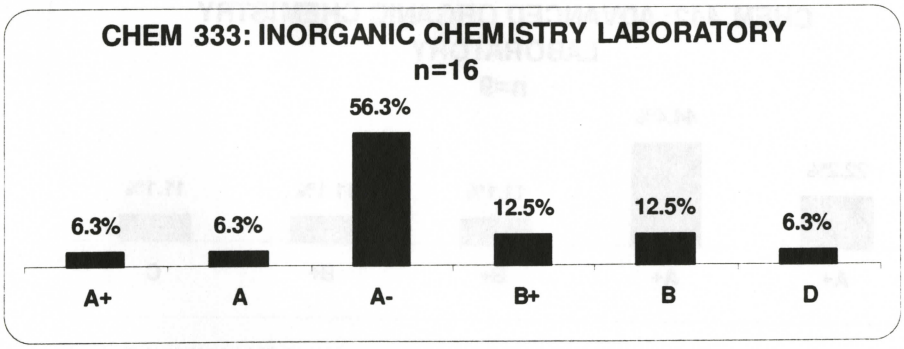

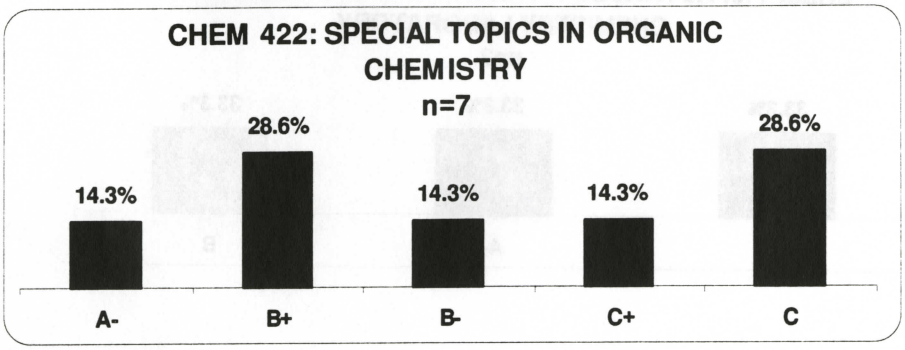

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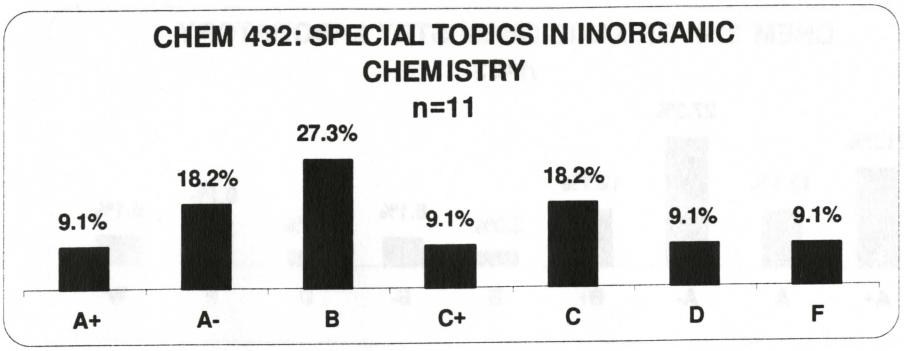

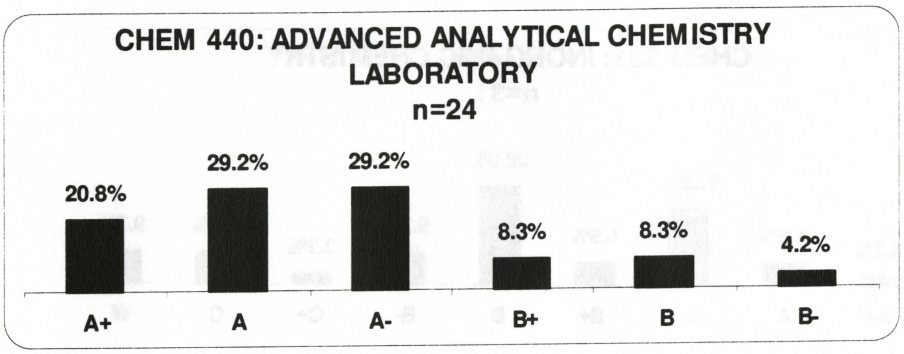

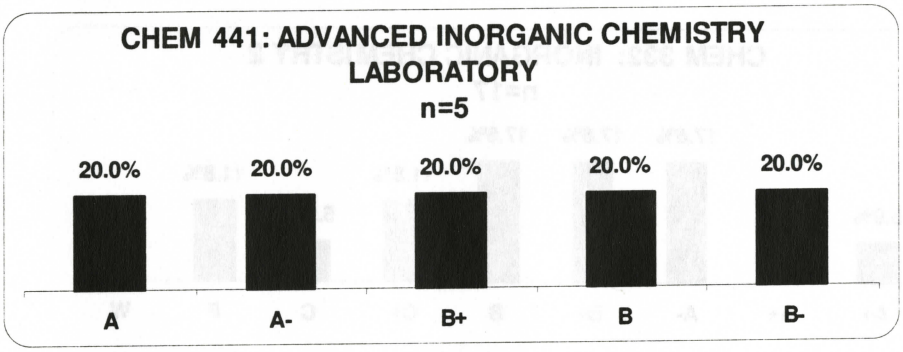

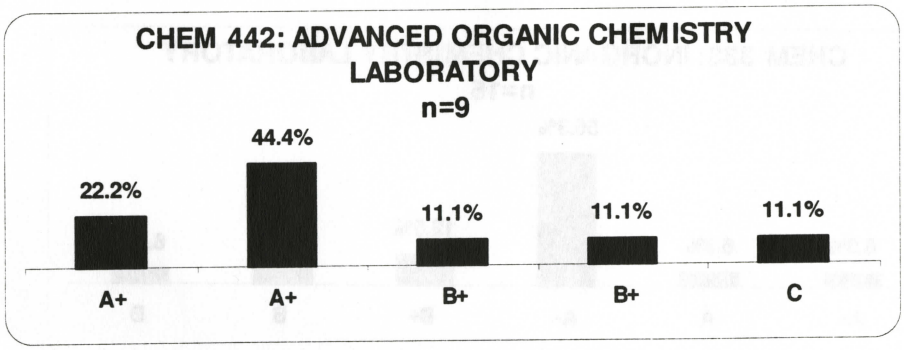

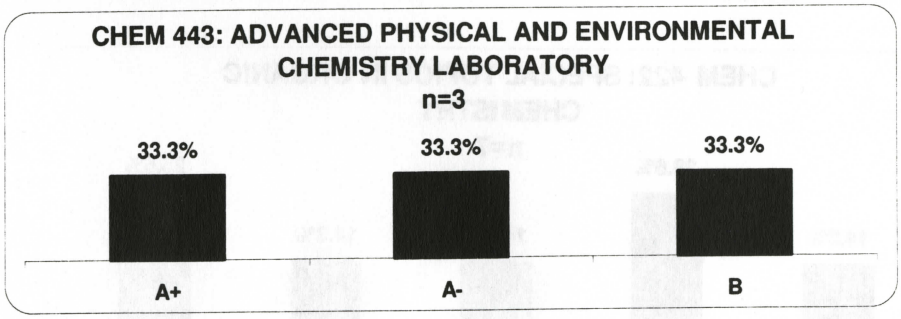

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