CHEMISTRY DEPARTMENT

Chemistry Student Handbook

FALL 2020

You can find us here:
https://www.millersville.edu/chemistry/

FORWARD

This handbook has been prepared for the benefit and use of students in the Chemistry Department. It brings together material not collected in other places and is not meant to be a rigid book, but rather one that will be revised as the need arises. The faculty hopes that this handbook will prove valuable to you.

TABLE OF CONTENTS

DEPARTMENTAL DIRECTORY

Department Chair: Dr. Aimee L. Miller

Office: Caputo 325
Phone: (717) - 871- 7414
Email: Aimee.Miller@millersville.edu

Department Office: Ms. Emily L. Drennen, Secretary

Office: Caputo Hall 234
Phone: (717) 871 – 4297
Email: Emily.Drennen@millersville.edu

Chemistry Faculty:

Name	Office	Phone	Email Address
Dr. Daniel R. Albert	Caputo Hall 214	871 – 7391	Daniel.Albert@millersville.edu
Dr. Kathryn R. Allen	Caputo Hall 317	871 – 7419	Kathryn.Allen@millersville.edu
Dr. Steven M. Bonser	Caputo Hall 323	871 – 7415	Steven.Bonser@millersville.edu
Dr. Michael S. Elioff	Caputo Hall 320	871 – 7417	Michael.Elioff@millersville.edu
Dr. Steven M. Kennedy	Caputo Hall 318	871 – 7418	Steven.Kennedy@millersville.edu
Dr. Jeremiah K.N. Mbindyo	Caputo Hall 321	871 – 7416	Jeremiah.Mbindyo@millersville.edu
Dr. Melissa A. Mullen Davis	Caputo Hall 218	871 – 7439	Melissa.MullenDavis@millersville.edu
Dr. R. Edward Rajaseelan	Caputo Hall 213	871 - 7395	Edward.Rajaseelan@millersville.edu
Dr. Lyman H. Rickard	Caputo Hall 215	871 – 7412	Lyman.Rickard@millersville.edu
Dr. Maria V. Schiza	Caputo Hall 219	871 – 7437	Maria.Schiza@millersville.edu

Chemistry Lab Technician:

Mr. Stephen W. Peurifoy Caputo Hall 330B 871 – 7413 Stephen.Peurifoy@millersville.edu

Back to Table of Contents

DEPARTMENT OVERVIEW

The Chemistry Department has 9 instructional laboratories which are capable of accommodating 12-24 students. Each instructional lab has been designed to meet the needs of a sub-discipline in chemistry: instrumental/quantitative analysis/environmental, biochemistry, inorganic, physical, organic/polymer and introductory chemistry.

The department occupies two floors of one wing of Caputo Hall, which also houses the Biology, Computer Science, Earth Science, Nursing, and Physics departments. The general chemistry and organic/polymer labs are on the third floor and the remaining labs are located on the second floor. The instrument room and the balance room are located centrally to the labs on the second floor. The NMR suite is located on the third floor adjacent to the organic lab. All students have ready access to the instrument room, the balance room, and the NMR suite.

All instructional labs are equipped with computers that are networked to printers and have internet access. There is a University computer lab located in the science complex (Roddy 257) that is open to all students 7 days a week. Both Mac and PC (20 units) platforms are supported and all computers are connected to the internet. This facility can be reserved for instructional purposes by the faculty. The facility now has wireless capabilities in the classrooms and instructional labs.

Each faculty member (11) has their own individual research facility where undergraduates conduct their research. These individual labs are equipped according to the specific needs of the faculty member's research interests. In addition to the basic equipment and other individual needs each room is equipped with a computer. We have access to facilities in the Biology and Physics Departments. In Biology, there is the greenhouse, the dark rooms, the microscopy suite that houses a SEM, and an animal facility should we need to use animals in any of our research or instructional labs. We have access to a vacuum deposition system and a machine shop through the Physics Department.

MAJOR EQUIPMENT

Atomic Absorption / Emission Flame & Graphite Furnace Spectrometer
Atomic Force / Scanning Tunneling Microscope
Fluorimeter
FT-IR (3 units)
Gas Chromatograph with FID, PID and TCD Detectors
Gas Chromatograph/Mass Spectrometer – GC/MS (1 unit)
Gel Documentation System
Capillary Electrophoresis System
Gel Permeation Chromatograph
HPLC equipped with a UV-VIS Detector (1 unit) and HPLC with Autosampler (2 units)
LC/MS Chromatograph with Autosampler
Electrochemistry/Cyclic Voltametry (2 units)
NMR [400 MHz] with Autosampler
UV-VIS Dual Beam Spectrophotometer
UV-VIS Single Beam Spectrophotometers (7 units) - [one unit equipped with an oxygen sensor]
Raman Spectrometer
Refrigerated Ultracentrifuge
Nanodrop Spectrometers (3 units) [UV-VIS and Fluorescence]

OTHER RESOURCES

We have a laboratory technician who is responsible for the general chemistry laboratories and the preparation of the lab exercises for all the introductory courses. Our technician has expertise in electronics and assists in computer interfacing and minor electronic repairs. Additional computer expertise is available from the University's Information Technology services.

PROGRAMS IN CHEMISTRY

There are eight courses of study offered by the Chemistry Department: BS-CHEM, BS-CHEM-BIOCHEMISTRY, BS-CHEM-ENVIRONMENTAL, BS-CHEM-NANOTECHNOLOGY, BS-CHEM-POLYMER, BS-CHEM-ENGINEERING-INSTRUMENTATION-AUTOMATION, BS-CHEM/3+4 PRE-PHARMACY, and BSE-CHEM. In general, students may easily transfer from one to the other of these programs, at least through the end of their sophomore year, as the departmental requirements of the programs are very similar for the first two years. By careful planning, a student may keep his or her options open to select from among several degrees almost until the time of graduation. Suggestions on how to accomplish this are given on the following pages, but you should consult your faculty advisor if you wish to plan such a flexible program of study.

THE GENERAL EDUCATION CURRICULUM RECORD FORM

On pages 8-9 is a copy of the General Education Curriculum Form. This version of the general education has been effective since fall 2012 and is for all undergraduate degree students who enrolled during or after the fall of 2012. On the form you will note that there are three general areas on the first page and one “Additional General Education Requirements" on the second page of the form. Each block **must** be filled by satisfactorily completing the course(s) specified or by one(s) that are described in the section on “Regulations Governing the Distribution of Courses.” On the ensuing pages you will find the major degree requirements sheets for all Chemistry programs. On these sheets, specific courses are sometimes given that are required by the program and satisfy a general education requirement at the same time. Be sure to make note of these courses when you read those forms.

Foundations for Lifelong Learning

- ENGL 110 English Composition
- COMM 100 Fundamentals of Speech
- MATH 1XX Gen Ed Approved Mathematics course
- One Upper Level Writing (AW) Course

Arts & Humanities (G1 Block)

- Art
- Communication & Theatre
- English
- Foreign Languages & Humanities
- Music
- Philosophy

Science & Mathematics (G2 Block) You must take at least two courses from these departments (including at least one lab):

- Biology
- Chemistry
- Earth Sciences
- Physics

You may also take approved courses from these departments:

- Computer Science (courses do not count as a natural science).
- Mathematics (additional to foundations required math course).
- Nursing

Social Sciences (G3 Block)

- African-American Studies
- Anthropology
- Business Administration
- Economics
- Geography
- Government & International Studies
- History
- Psychology
- Sociology
- Social Work/Gerontology
- Women's Studies

Connections & Exploration/Cultural Diversity

- First-Year Inquiry Seminar (FYI, UNIV 103)
- Perspectives (P) Course
- Wellness/Health Education Course (WELL 175 or 352)
- Cultural Diversity & Community (D) Course

Some General Education requirements will be satisfied by courses that are already a required part of a chemistry student's program.

- **G2 Block:** Required related courses (math & physics) will satisfy the G2 block completely.

- **200-level Courses:** Required related courses (math & physics) will satisfy the requirement that at least three (3) courses of G1/G2/G3 courses be at 200 level or above.

- **W Courses:** CHEM 341 and CHEM 342 (Physical Chemistry I and II) and CHEM 465 (Analytical Chemistry) carry the writing label (W) and satisfy the requirement for three (3) W courses. (BSE students as well as students in the BS Chemistry Nanotechnology and 3+4 Pre-Pharmacy options will need to take a W course outside of chemistry.)

- **CDC Requirement:** CHEM 375 (Environmental Chemistry) carries the cultural diversity & community label (D) and satisfies the requirement for one D course for student who take it.

*Please remember that the material written above is meant to serve **as a guide only**. You should consult your faculty advisor and the University catalog regularly for more detailed information.

Effective Fall Semester, 2012

MILLERSVILLE UNIVERSITY

General Education Curriculum Guide *(Purple Sheet)*

Student Name: ..... **Student I.D. #** .....

Critical Thinking Across the Liberal Arts (Gl-G3)

General Guidelines:

Only approved General Education (GenEd) courses may be used.
Courses must be taken from at least two departments within each G1, G2, and G3 block.
At least three courses taken throughout blocks G1, G2 &/or G3 must be at the 200 level or above.
Up to six "Required Related" courses may be counted toward GenEd requirements.
Courses from the primary major may not fulfill the G1, G2, and G3 blocks; courses from a minor or secondary major may fulfill these blocks.

Gl. Humanities and Fine Arts: Three courses minimum totaling at least 9 credit hours.

Select courses from: Art, Communications & Theatre, English, Foreign Language (which includes HUMN courses), Music or Philosophy. Students majoring in a Humanities & Fine Arts department may not count courses from the major department in this block.

Subject/Course#	Course Title	Cr. Hrs.
1.		
2.		
3.		

G2. Science and Mathematics: Three courses minimum totaling at least 9 credit hours.

Select courses from: Biology, Chemistry, Computer Science, Earth Sciences, Mathematics, Nursing or Physics. Students majoring in a Science or Mathematics department may not count courses from the major department in this block.

Additional Guidelines:

At least two courses must be taken from the "natural sciences": Biology, Chemistry, Earth Sciences and Physics. This can be two courses from any one of these departments **OR** one course from any two of these departments.
One course taken within the G2 block must be a Lab course.

Subject/Course#	Course Title	Cr. Hrs.	2 from Natural Sci.	1 Lab Course
1.				
2.				
3.				

G3. Social Sciences: Three courses minimum totaling at least 9 credit hours.

Select courses from: African-American Studies, Anthropology, Business Administration, Economics, Geography, Government, History, International Studies, Occupational Safety & Environmental Health, Psychology, Sociology, Social Work/Gerontology, or Women's Studies. Students majoring in the Social Sciences areas may not count courses from their major department in this block.

Subject/Course#	Course Title	Cr. Hrs.
1.		
2.		
3.		

Additional General Education Requirements

Foundations for Lifelong Learning (4 courses minimum 12 credit hours)

This category requires: **1. ENGL 110, 2. COMM 100, 3. GenEd (G2) approved Mathematics course (MATH lXX), and 4. Advanced Writing (AW) course (ENGL 311,312,313, or 316).**

Guidelines:

ENGL 110 must be completed with a grade of C- or better.
COMM 100 must be completed with a grade of C- or better.
The upper level writing (AW) course has a prerequisite of ENGL 110 (C- or better) and a minimum of 60 credit hours completed. Many majors recommend or require a specific AW course. Check the catalog for further details.
G2 Math course must be different from that used towards the G2 block in the Liberal Arts Core.

Subject/Course#	Course Title	Cr. Hrs.
1. ENGL 110	English Composition	3.0
2. COMM 100	Fundamentals of Speech	3.0
3.MATH		
4.ENGL		

Connections & Exploration Courses (minimum 9 credit hours)

Guidelines/Prerequisites:

1. **First-Year Inquiry (FYI) Seminar - UNIV 103 (3 credit hours) or Open Elective (3 credit hours)**
   Open electives must be 100 level or above and must be taken outside of primary major.
   For BSE students, required professional education courses **cannot** count as open electives.
2. **Perspectives (P) Course (3 credit hours)**
   May be satisfied with approved courses from the major, the minor, the required related area, or general electives.
   ENGL 110 and COMM 100 completed with grades of C- or better.
   Minimum of 60 credit hours completed.
3. **Wellness/Health Education course (3 credit hours)**
   Any WELL 175 course will fulfill this requirement.
   Early Childhood Education or Early Childhood/Special Education majors are required to take WELL 240.

Subject/Course#	Course Title	Cr. Hrs.
1.		
2.		
3.		

Cultural Diversity & Community (D) Course

May be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

Subject/Course#	Course Title	Cr. Hrs.
1.		

Writing Intensive (W) Courses (3 courses)

Guidelines/Prerequisites:

May be satisfied with approved courses from the GenEd requirements, the major, the minor, the required related area, or general electives.
ENGL 110 must be completed with a grade of C- or better.

Subject/Course#	Course Title	Cr. Hrs.
1.		
2.		
3.		

Developmental Courses (COMM 010, EDUC 090, ENGL 010, MATH 090)

These do not count toward the 120 credit hours required for graduation.

Revised by L. Lynn Marquez 9/13/2012

THE MAJOR REQUIREMENTS FOR DEGREES IN CHEMISTRY

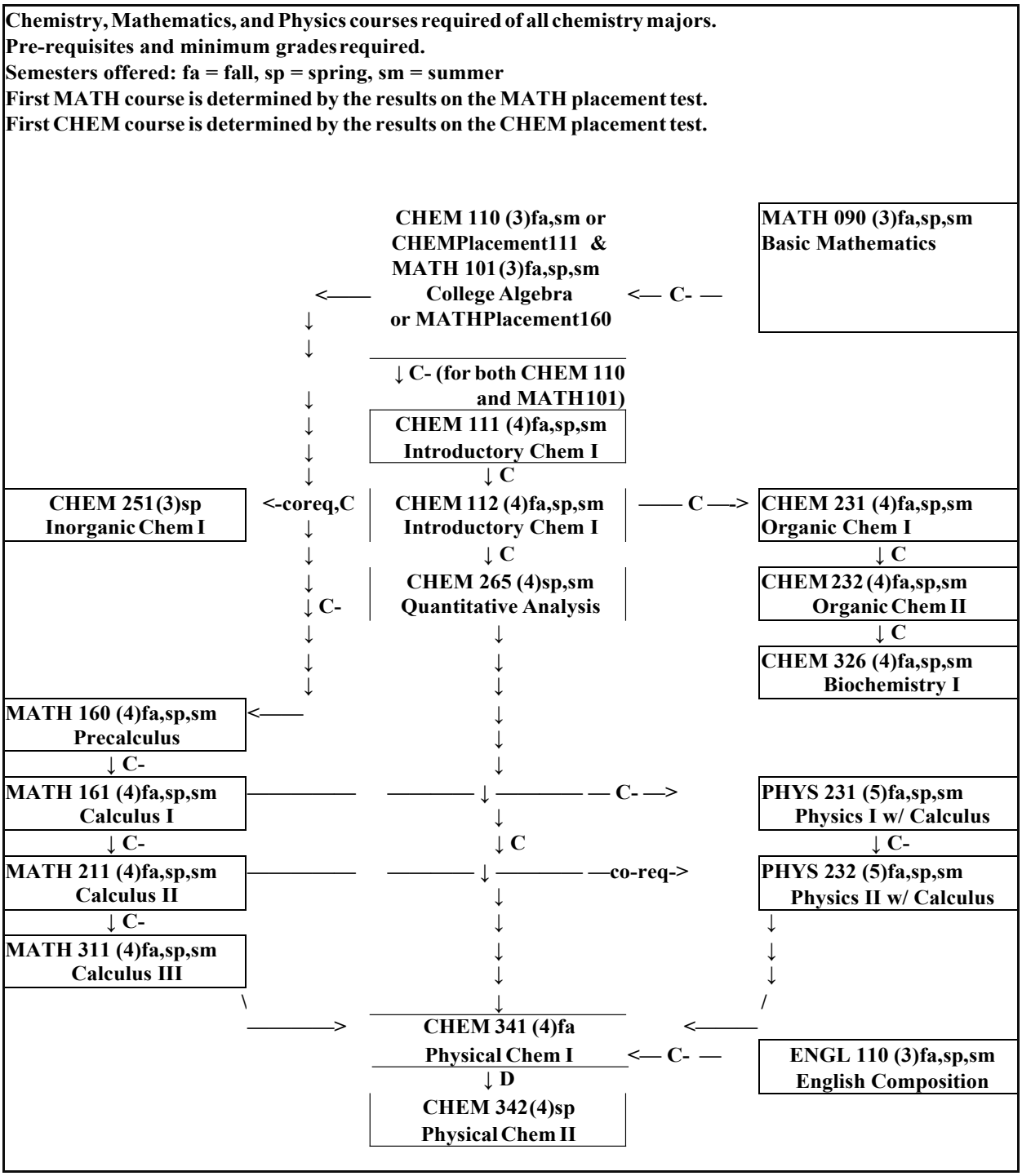
Beginning on page 11, the degree requirements for all of the programs in chemistry are described. The following descriptions are included for each program: Major Requirements for the Degree, Major Sequence and Degree Requirements, and a Recommended Program. The Recommended Program is an example of a possible four-year schedule. Your exact schedule will probably differ and should be developed with the advice of your faculty advisor.

An example of a four-year schedule is given for the B.S. degree program. Students who are considering graduate school or who intend to seek employment with a major national company should choose a research experience in order to be more competitive. Although all of the B.S. degree programs in chemistry require one semester of research, several semesters of research under the direction of a faculty member are necessary in order to make significant progress on a research investigation. Students interested in doing more than one credit of research should choose a faculty member to work with and select a research problem by their junior year. Students planning to seek employment with a major national company are encouraged to seek a co-op experience.

Students involved in an extended research experience and who have a minimum of a 3.0 QPA are encouraged to consider participation in Departmental Honors. Interested students should discuss this with their faculty advisor or research advisor. Additional details describing departmental honors are found on page 71-74 of this handbook.

ATTENTION CHEMISTRY MAJORS IN ALL DEGREE PROGRAMS

Before being allowed to enroll in a new chemistry course, chemistry majors must have achieved a grade of C or better (C- is not acceptable) in 100 and 200-level prerequisite chemistry courses. The diagram below includes all prerequisite grades for the chemistry courses sequence into the junior year.



B.S. CERTIFICATION BY THE AMERICAN CHEMICAL SOCIETY

The Bachelor of Science in Chemistry is designed for the student planning to be a professional chemist. It can lead to certification by the American Chemical Society. Although many chemists have not earned a certified degree, certification has significant benefits to the new graduate. A certified chemist may immediately become a member of the American Chemical Society. Many graduate schools, professional schools, and employers are eager to accept certified graduates as they recognize that these graduates have pursued a more rigorous program of study than have non-certified graduates.

The requirements for certification are set by the Committee on Professional Training (CPT) of the American Chemical Society. In July of each year the chairperson of the department forwards a list of certified graduates to the secretary of the CPT. The CPT secretary then sends each certified graduate a certificate recognizing his or her certification.

In order to become a certified chemistry graduate, a student must fulfill each of the following criteria:

a. Successfully complete the program of study leading to the Bachelor of Science in Chemistry (BS-CHEM) degree, **or** the Bachelor of Science in Chemistry/Biochemistry (BS-CHEM/BIOCHEM) degree.

b. Take all chemistry courses in the sequence given in the college catalog. For the BS-CHEM degree, particularly note the prerequisites for each course. For example, make sure you have successfully completed Physical Chemistry II (CHEM 342) before you begin either Advanced Inorganic Chemistry (CHEM 452) or Analytical Chemistry (CHEM 465).

c. Students seeking certification must take a minimum of two credits of CHEM 498 under the Chemistry Elective block.

Technical Writing (ENGL 312), a course in Computer Science, competence in a foreign language at the elementary level, and an economics course are strongly recommended by the department and the American Chemical Society. They are not required by either group in order to certify a chemistry graduate from Millersville University.

In order to have any of the above requirements waived, you should present a typed petition stating your request and the reasons why you believe it should be granted to the chairperson of the department. Your petition will be considered by the full faculty of the department at its next regular meeting and you will be informed in writing of the Department's decision.

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE: BS

MAJOR: CHEM

OPTION:

MAJOR REQUIREMENTS FOR A BS DEGREE IN CHEMISTRY

Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

American Chemical Society Certification

A student opting for ACS certification should take all chemistry courses in the given sequence in the college catalog. The student must have successfully completed Physical Chemistry II (CHEM 342) before beginning Advanced Inorganic (CHEM 452) or Analytical Chemistry (CHEM 465).

In compliance with the ACS Guidelines, the department highly recommends a modern foreign language (FORL 101-102; G1 Humanities elective) and an elementary economics course (Social Science: G3 elective) for ACS certification.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

Back to Table of Contents

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option:
Major Field Requirements:**55.0-57.0 Credits**
Other Requirements: **24.0-26.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (47.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	326	Biochemistry I	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	465	Analytical Chem*	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Independent Study	1.0	

CHEMISTRY ELECTIVES (8.0-10.0 Credits)

CHEM	312	Chem in Nanotech	3.0	
CHEM	324	Plant Biochemistry	4.0	
CHEM	327	Biochemistry II	4.0	
CHEM	328	Analyt. Biochem Lab	1.0	
CHEM	375	Environmental Chem	4.0	
CHEM	381	Polymer Chem I	4.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	476	Environmental Chem II	4.0	
CHEM	482	Polymer Chem II	4.0	
CHEM	486	Topics in Chemistry	1-4	
CHEM	498	Independent Study **	1-3	
CHEM	489	Dept. Honors	1-3	
CHEM	499	Dept. Honors	1-3	
CHEM	300	Cooperative Educ	3.0	
CHEM	400	Cooperative Educ	3.0	

*Students not seeking ACS certification may corequisite CHEM 342 and CHEM 465.
** Students seeking ACS certification must take a minimum of two hours credit of CHEM 498 under Chemistry Electives.

REQUIRED RELATED (24.0-26.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Physics, Mathematics, and/or Computer Science Electives (Choose one course)

Physics-any course numbered 233 or higher, except perspectives courses. (2.0-3.0 credits)

CSCI	161	Intro to Programming I	4.0	
CSCI	162	Intro to Programming II	4.0	
MATH	235	Survey of Statistics	3.0	
MATH	236	Elements of Stat. II	3.0	
MATH	322	Linear Algebra	4.0	
MATH	333	Intro to Prob. & Stats	4.0	
MATH	335	Math Stat I	3.0	
MATH	365	Differential Equations	3.0	
MATH	435	Math Stat II	3.0	

The total number of credits earned in both elective blocks must be 12 credits.

General Electives (as necessary)

BACHELOR OF SCIENCE IN CHEMISTRY
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. of Speech	3.0
ENGL	110	English Composition	3.0	CHEM	251	Inorganic I	3.0
_____	____	Social Sciences Course #1	3.0			*TOTAL S.H.*	14.0
		TOTAL S.H.	15.0				

		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
WELL	175	Wellness	3.0	_____	____	Humanities Course #1	3.0
		TOTAL S.H.	16.0			*TOTAL S.H.*	16.0

		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	391	Advanced Lab I	1.0	CHEM	392	Advanced Lab II	1.0
_____	____	Humanities Course #2	3.0	CHEM	____	Chemistry Elective	4.0
_____	____	Social Sciences Course #2	3.0	_____	____	Humanities Course #3	3.0
ENGL	312	Technical Writing	3.0	_____	____	Math/Phys Elective	2-4.0
		TOTAL S.H.	14.0			*TOTAL S.H.*	14-16.0

		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	326	Biochemistry I	4.0	CHEM	465	Analytical Chemistry	4.0
CHEM	452	Inorganic II	3.0	CHEM	488	Chemistry Seminar	0.5
CHEM	487	Chemistry Seminar	0.5	CHEM	____	Chemistry Elective	4.0
CHEM	498	Intro to Research	1.0	_____	____	C&E Course #1	3.0
_____	____	Perspectives Course	3.0	_____	____	C&E Course #4	3.0
_____	____	Social Sciences Course #3	3.0			*TOTAL S.H*	14.5
		TOTAL S.H.	14.5				

COMMENTS, NOTES OR RECOMMENDATIONS:

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended.

11/10

BACHELOR OF SCIENCE IN CHEMISTRY
3-Year Plan
***This Program Sheet does not include all of the requirements for an ACS Certified Bachelor of Chemistry Degree.**

YEAR 1

First Semester				**Second Semester**			
CHEM	111	Intro Chem I	4.0	CHEM	251	Inorganic I	3.0
CHEM	188	Freshman Seminar	1.0	CHEM	112	Intro Chem II	4.0
MATH	161	Calculus I	4.0	MATH	211	Calculus II	4.0
ENGL	110	English Composition	3.0	COMM	100	Fund. Of Speech	3.0
_____	___	Social Science Course #1	3.0			*TOTAL S.H.*	*14.0*
		TOTAL S.H.	*15.0*				
		Winter Session		_____	___	Social Science Course #2	3.0
						TOTAL S.H.	*3.0*
		Summer Sessions					
		Summer 1		CHEM	231	Organic I	4.0
		Summer 2		CHEM	232	Organic II	4.0
		Summer 3		_____	___	Humanities Course #1	3.0
						TOTAL S.H.	*11.0*

YEAR 2

Third Semester				**Fourth Semester**			
CHEM	391	Advanced Lab I	1.0	CHEM	392	Advanced Lab II	1.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
_____	___	Chemistry Elective	4.0	ENGL	312	Technical Writing	3.0
		TOTAL S.H.	*14.0*	_____	___	C&E Course #1	3.0
						TOTAL S.H.	*16.0*
		Winter Session		WELL	175	Wellness	3.0
						TOTAL S.H.	*3.0*
		Summer Sessions					
		Summer 1		CHEM	326	Biochemistry I	4.0
		Summer 2		_____	___	Humanities Course #2	3.0
		Summer 3			___	C&E Course #2	3.0
						TOTAL S.H.	*9.0*

YEAR 3

Fifth Semester				**Sixth Semester**			
CHEM	341	Physical Chemistry I	4.0	CHEM	342	Physical Chemistry II	4.0
CHEM	452	Inorganic II	3.0	CHEM	465	Analytical Chemistry	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	488	Chemistry Seminar	0.5
CHEM	498	Intro to Research	1.0	_____	___	Chemistry Elective	4.0
_____	___	Perspectives Course	3.0	_____	___	Humanities Course #3	3.0
_____	___	Math/Phys Elective	3.0			*TOTAL S.H.*	*15.5*
		TOTAL S.H.	*14.5*				
		Winter Session				Social Science Course #3	3.0
						TOTAL S.H.	*3.0*

BACHELOR OF SCIENCE IN CHEMISTRY
3-Year Plan
***This plan is for students matriculating with AP Chemistry (Chem 111) & Calculus AB (Math 161).**

YEAR 1

First Semester				**Second Semester**			
CHEM	112	Intro Chem II	4.0	CHEM	251	Inorganic I	3.0
CHEM	188	Freshman Seminar	1.0	CHEM	265	Quant. Analysis	4.0
MATH	211	Calculus II	4.0	PHYS	232	Physics II w/ Calculus	5.0
PHYS	231	Physics I w/ Calculus	5.0	MATH	311	Calculus III	4.0
		TOTAL S.H.	*14.0*			*TOTAL S.H.*	*16.0*
				Winter Session	ENGL	110 English Composition	3.0
						TOTAL S.H.	*3.0*
				Summer Sessions			
				Summer 1	CHEM	231 Organic I	4.0
				Summer 2	CHEM	232 Organic II	4.0
				Summer 3	_____	Humanities Course #1	3.0
						TOTAL S.H.	*11.0*

YEAR 2

Third Semester				**Fourth Semester**			
CHEM	391	Advanced Lab I	1.0	CHEM	392	Advanced Lab II	1.0
CHEM	341	Physical Chemistry I	4.0	CHEM	342	Physical Chemistry II	4.0
CHEM	498	Intro to Research	1.0	WELL	175	Wellness	3.0
_____	___	Chemistry Elective	4.0	COMM	100	Fund. Of Speech	3.0
_____	___	Social Science Course #1	3.0	_____		Perspectives Course	3.0
		TOTAL S.H.	*13.0*			*TOTAL S.H.*	*14.0*
				Winter Session		Social Science Course #2	3.0
						TOTAL S.H.	*3.0*
				Summer Sessions			
				Summer 1	_____ ___	Social Science Course #3	3.0
				Summer 2	_____ ___	Humanities Course #2	3.0
				Summer 3	___	C&E Course #1	3.0
						TOTAL S.H.	*9.0*

YEAR 3

Fifth Semester				**Sixth Semester**			
CHEM	452	Inorganic II	3.0	CHEM	465	Analytical Chemistry	4.0
CHEM	326	Biochemistry I	4.0	CHEM	488	Chemistry Seminar	0.5
CHEM	487	Chemistry Seminar	0.5	_____	___	Chemistry Elective	4.0
ENGL	312	Technical Writing	3.0	_____	___	Humanities Course #3	3.0
_____	___	Math/Phys Elective	3.0	_____	___	C&E Course #2	3.0
		TOTAL S.H.	*13.5*			*TOTAL S.H.*	*14.5*

Back to Table of Contents

BACHELOR OF SCIENCE IN CHEMISTRY / OPTION IN BIOCHEMISTRY

This curriculum is designed to produce a graduate trained in the area of biochemistry. Many previous graduates have gone on to graduate school in biochemistry or to professional school in the health professions. Note that the BS-CHEM-BIOCHEM curriculum requires that students seeking ACS certification in biochemistry must take 2 credit hours of CHEM 498 in the Chemistry Electives block. The research being performed on the Millersville campus is of such a nature that many students' efforts have been published or presented at scientific conferences.

The Department's view of biochemistry is that one must first be a good chemist before one can become a biochemist. The biochemistry program provides the student with a basic background in chemistry and biology as well as a flexible science elective block that will allow the student to pursue any one of a number of major areas of interest upon graduation. The student may also elect to participate in the Cooperative Education Program during his or her course of study. This opportunity affords the student with invaluable practical on-the-job experience, as well as earning college credits and a salary.

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE: BS

MAJOR: CHEM

OPTION: BIOCHEM

MAJOR REQUIREMENTS FOR A BS DEGREE IN CHEMISTRY/ BIOCHEMISTRY

Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

American Chemical Society Certification

In compliance with the ACS Guidelines, the department highly recommends a modern foreign language (FORL 101-102; G1 Humanities elective) and an elementary economics course (Social Science: G3 elective) for ACS certification.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **BIOCHEMISTRY**
Major Field Requirements: **52.0 Credits**
Other Requirements: **29.0-30.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (47.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	326	Biochemistry I	4.0	
CHEM	327	Biochemistry II	4.0	
CHEM	328	Analytical Biochem Lab	1.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	465	Analytical Chemistry	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Independent Study	1.0	

CHEMISTRY ELECTIVES (5.0 Credits)

CHEM	312	Chem in Nanotech	3.0	
CHEM	324	Plant Biochemistry	4.0	
CHEM	375	Environmental Chem	4.0	
CHEM	381	Polymer Chemistry I	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II*	1.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	476	Environmental Chem II	4.0	
CHEM	482	Polymer Chemistry II	3.0	
CHEM	486	Topics in Chemistry	1-4	
CHEM	498	Independent Study **	1-3	
CHEM	489	Department Honors	1-3	
CHEM	499	Department Honors	1-3	
CHEM	300	Cooperative Educ	3.0	
CHEM	400	Cooperative Educ	3.0	

* This elective must be completed to gain ACS certification in Biochemistry.
** Students seeking ACS certification must take a minimum of two hours credit of CHEM 498 under Chemistry Electives.

REQUIRED RELATED (29.0-30.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

BIOLOGY (7.0-8.0 credits)

Demonstrate competency in Biology 100*

BIOL	364	Fndns Genetics/Mole	4.0	

Select one additional course from the following:

BIOL	362	Cell/Devel Biology	4.0	
BIOL	461	General Microbiol	3.0	
BIOL	462	Molecular Biology	4.0	

*Competency may be demonstrated by one of the following:
1) a course grade of "A" or "B" in AP Biology
2) a score of 3 or better in the national AP exam
3) a successful score on the CLEP exam
4) a passing grade for General Biology (BIOL 100): required for 300 or 400-level courses. B- or higher is required if changing to biology major.

General Electives(as necessary)

BACHELOR OF SCIENCE IN CHEMISTRY
BIOCHEMISTRY OPTION
RECOMMENDED PROGRAM (1)

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	CHEM	251	Inorganic Chem I	3.0
BIOL	100	General Biology	3.0	COMM	100	Fund. of Speech	3.0
MATH	161	Calculus I	4.0	MATH	211	Calculus II	4.0
ENGL	110	English Composition	3.0	WELL	175	Wellness	3.0
		TOTAL S.H.	15.0			*TOTAL S.H.*	17.0
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
_____	____	Humanities Course #1	3.0	_____	____	Humanities Course #2	3.0
		TOTAL S.H.	16.0			*TOTAL S.H.*	16.0
		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
BIOL	364	Fund Genetics & Molecu	4.0	CHEM	392*	Advanced Lab II	1.0
_____	____	Humanities Course #3	3.0	CHEM	____	Chemistry Elective	3.0
_____	____	Social Sciences Course #1	3.0	ENGL	312	Technical Writing	3.0
		TOTAL S.H.	14.0	_____	____	Social Sciences Course #2	3.0
						TOTAL S.H.	14.0
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	326	Biochemistry I	4.0	CHEM	327	Biochemistry II	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	328	Anal Biochemistry Lab	1.0
CHEM	____	Chemistry Elective***	2.0	CHEM	465	Analytical Chemistry	4.0
BIOL	____	Req'd Biol. Course	3-4.0	CHEM	488	Chemistry Seminar	0.5
_____	____	C&E Course #1	3.0	_____	____	C&E Course #4	3.0
_____	____	Social Science Course #3	3.0	_____	____	Perspectives Course	3.0
		TOTAL S.H.	15.5-16.5			*TOTAL S.H.*	15.5

COMMENTS, NOTES OR RECOMMENDATIONS:

* Students opting for ACS Certification in Biochemistry should take Advanced Laboratory II (CHEM 392). The prerequisite of CHEM 391 has been waived for biochemistry majors.

** If you choose to take Genetics in the same year as CHEM 327 and 328, you MUST do so in the FALL semester to avoid scheduling conflicts in the spring semester.

*** Students seeking ACS Certification must take a minimum of 2 credit hours of CHEM 498 in the Chemistry Elective Block.

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended.

[See the next page for an alternate program sequence.] 7/10

BACHELOR OF SCIENCE IN CHEMISTRY
BIOCHEMISTRY OPTION
RECOMMENDED PROGRAM (2)

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	CHEM	251	Inorganic Chem I	3.0
BIOL	100	General Biology	3.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. of Speech	3.0
ENGL	110	English Composition	3.0	WELL	175	Wellness	3.0
		TOTAL S.H.	15.0			*TOTAL S.H.*	17.0
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
_____	____	G1 or G3 Course #1	3.0	_____	____	G1 or G3 Course #2	3.0
		TOTAL S.H.	16.0			*TOTAL S.H.*	16.0
		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	326	Biochemistry I	4.0	CHEM	327	Biochemistry II	4.0
BIOL	364	Fund Genetics & Molecu	4.0	CHEM	328	Anal Biochemistry Lab	1.0
ENGL	312	Technical Writing	3.0	CHEM	498	Intro to Research	1.0
_____	____	G1 or G3 Course #3	3.0	_____	____	G1 or G3 Course #4	3.0
		TOTAL S.H.	14.0	_____	____	G1 or G3 Course #5	3.0
				_____	____	Perspectives Course	3.0
						TOTAL S.H.	15.0
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
BIOL	____	Req'd Biology Course	3.0-4.0	CHEM	465	Analytical Chemistry	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	488	Chemistry Seminar	0.5
CHEM	____	Chemistry Elective***	2.0	CHEM	____	Chemistry Elective	3.0
_____	____	G1 or G3 Course #6	3.0	CHEM	392*	Advanced Lab II	1.0
_____	____	C&E Course #1	3.0	_____	____	C&E Course #4	3.0
		TOTAL S.H.	15.5-16.5			*TOTAL S.H.*	15.5

COMMENTS, NOTES OR RECOMMENDATIONS:

* Students opting for ACS Certification in Biochemistry should take Advanced Laboratory II (CHEM 392). The prerequisite of CHEM 391 has been waived for biochemistry majors.

** If you choose to take Genetics in the same year as CHEM 327 and 328, you MUST do so in the FALL semester to avoid scheduling conflicts in the spring semester.

*** Students seeking ACS Certification must take a minimum of 2 credit hours of CHEM 498 in the Chemistry Elective Block.

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved Gen Ed course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the Gen Ed requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended.

7/10

BACHELOR OF SCIENCE IN CHEMISTRY/OPTION IN ENVIRONMENTAL CHEMISTRY

Environmental chemistry touches not only upon all areas of science but also upon issues of social, economic, and political importance. In general, areas of activity involve the traditional chemistry of the atmosphere, hydrosphere, geosphere, and biosphere. Included within these broad areas are a multitude of more specialized fields such as environmental toxicology/risk assessment; hydrogeological remediation and hazardous waste management; industrial hygiene; environmental engineering; ethics, law, and regulation; computer modeling; statistics; quality control and chemical analysis.

In order to accommodate the anticipated growth in this field of study, the Millersville University Department of Chemistry offers a B.S. Chemistry degree with an option in Environmental Chemistry. The curriculum offers courses with contents that are consistent with similar programs offered elsewhere and, with electives in Inorganic Chemistry and Biochemistry, that will satisfy the guidelines of an option in Environmental Chemistry certified by the ACS Committee on Professional Training.

In addition to course requirements, the curriculum includes opportunities for industrial and government internship programs related to environmental analysis, engineering, and regulation. Of more immediate promise is the interest expressed by Lancaster Laboratories in generating a student internship program with the Chemistry Department. These internships include such areas as research in sampling and instrumental analysis of many different kinds of materials, toxicity and risk assessment, field testing and monitoring, drug screening, environmental law and regulations, analysis of food products, and quality assurance in the chemical laboratory.

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE: BS

MAJOR: CHEM

OPTION: ENVIR

MAJOR REQUIREMENTS FOR A BS DEGREE IN ENVIRONMENTAL CHEMISTRY

Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **ENVIRONMENTAL**
Major Field Requirements: **50.0 Credits**
Other Requirements: **31.0-32.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (46.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	375	Environmental Chem	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	465	Analytical Chem	4.0	
CHEM	476	Environmental Chem II	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Independent Study	1.0	

CHEMISTRY ELECTIVES (4.0 Credi s)

CHEM	312	Chem in Nanotech	3.0	
CHEM	324	Plant Biochemistry	4.0	
CHEM	326	Biochemistry I*	4.0	
CHEM	327	Biochemistry II	4.0	
CHEM	328	Analytical Biochem Lab	1.0	
CHEM	381	Polymer Chem I	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	435	Adv. Organic Chem	3.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	486	Topics in Chemistry	1-4	
CHEM	498	Independent Study	1-3	
CHEM	489	Department Honors	1-3	
CHEM	499	Department Honors	1-3	
CHEM	300	Cooperative Educ	3.0	
CHEM	400	Cooperative Educ	3.0	

* This elective is recommended for the Environmental Option by the American Chemical Society.

REQUIRED RELATED (31.0-32.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Biology

Competency equivalent to BIOL 100*

Select 3 courses from the following: (9.0-10.0 credits)

BIOL	241	Principles of Ecology	3.0	
ESCI	245	Environ. Meteorology	3.0	
ESCI	349	Chem of Atmosphere	3.0	
ESCI	426	Groundwater Geo.	3.0	
GEOG	202	Resources & Environ.	3.0	
OSEH	321	Industrial Hygiene	4.0	

*Competency may be demonstrated by one of the following:
1) a course grade of "A" or "B" in AP Biology
2) a score of 3 or better in the national AP exam
3) a successful score on the CLEP exam
4) a passing grade for General Biology (BIOL 100)

General Electives (as necessary)

BACHELOR OF SCIENCE IN CHEMISTRY
ENVIRONMENTAL CHEMISTRY OPTION
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	CHEM	251	Inorganic	3.0
ENGL	110	English Composition	3.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	WELL	175	Wellness Course	3.0
_____	_____	Humanities Course #1	3.0			*TOTAL S.H.*	14.0
		TOTAL S.H.	15.0				

		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
COMM	100	Communication	3.0	CHEM	265	Quantitative Analysis	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0			*TOTAL S.H.*	13.0
		TOTAL S.H.	16.0				

		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	375	Environmental I	4.0	CHEM	476	Environmental II	4.0
ENGL	312	Technical Writing	3.0	_____	_____	Required Related **	3.0-4.0
_____	_____	Humanities Course #2	3.0	_____	_____	Social Sciences Course #2	3.0
_____	_____	Social Sciences Course #1	3.0			*TOTAL S.H.*	14.0-15.0
		TOTAL S.H.	17.0				

		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	_____	Chemistry Elective *	4.0	CHEM	465	Analytical Chemistry	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	488	Chemistry Seminar	0.5
CHEM	498	Intro to Research	1.0	_____	_____	C&E Course #4	3.0
_____	_____	Required Related **	3.0-4.0	_____	_____	Required Related **	3.0-4.0
_____	_____	Humanities Course #3	3.0	_____	_____	Perspectives Course	3.0
_____	_____	Social Science Course #3	3.0			*TOTAL S.H.*	13.5-14.5
_____	_____	C&E Course #1	3.0				
		TOTAL S.H.	17.5-18.5				

COMMENTS, NOTES OR RECOMMENDATIONS:

* Biochemistry I (CHEM 326) is a recommended elective by the ACS for the Environmental Chemistry Option.
**Select 3 courses from the following: BIOL 241, Principles of Ecology; ESCI 245, Environmental Meteorology; ESCI 426, Groundwater Geology; GEOG 202, Resources & the Environment; or OSEH 321, Environmental & Industrial Hygiene I.

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved Gen Ed course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the Gen Ed requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended. 11/10

Back to Table of Contents

BACHELOR OF SCIENCE IN CHEMISTRY/OPTION IN NANOTECHNOLOGY

The Chemistry Department at Millersville offers a B.S. Chemistry degree with an option in Nanotechnology. The curriculum includes courses that give students a strong background in chemistry with electives in nanotechnology and other sciences. As part of the current program, students spend a semester at the Penn State University Nanofabrication Facility to gain practical experience in nanofabrication and the use of clean room facilities. Nanotechnology, which is the control of materials at very small dimensions to make smaller, cheaper, and better products, is being adopted in many industries. Upon graduation, students can pursue graduate studies in chemistry or materials sciences. Students are also prepared to work in industry or government, usually in an environment involving interaction with scientists from other disciplines such as biology, physics, and engineering.

The National Science Foundation projects that by 2010, the U.S. will need one million nanotechnology workers. Within the Commonwealth, biotechnology and pharmaceutical research companies are actively seeking individuals with biological semiconductor interfacing. The skills of many science graduates are changing and familiarity with submicron manufacturing processes and analysis are becoming necessary across many disciplines. It is anticipated that this option will enhance the opportunities of our students to enter graduate programs and industry.

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN**
MAJOR:	CHEM	**CHEMISTRY**
OPTION:	NANOTECH	Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the of sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

American Chemical Society Certification

A student opting for ACS certification should take all chemistry courses in the given sequence in the college catalog. The student must have successfully completed Physical Chemistry II (CHEM 342) before beginning Advanced Inorganic (CHEM 452) or Analytical Chemistry (CHEM 465).

In compliance with the ACS Guidelines, the department highly recommends a modern foreign language (FORL 101-102; G1 Humanities elective) and an elementary economics course (Social Science: G3 elective) for ACS certification.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **NANOTECHNOLOGY**
Major Field Requirements: **41.0 Credits**
Other Requirements: **40.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (37.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	312	Chem in Nanotech	3.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Independent Study	1.0	

Electives (4.0 credits)

Course	No.	Short Title	C.H.	Grade
CHEM	300	Co-op in Chem	3.0	
CHEM	326	Biochemistry I	4.0	
CHEM	375	Environmental Chem	4.0	
CHEM	381	Polymer Chem I	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	465	Analytical Chem	4.0	
CHEM	486	Topics in Chem	1-4	
CHEM	498	Independent Study	1-3	
CHEM	489	Dept. Honors	1-3	
CHEM	499	Dept. Honors	1-3	

PROFESSIONAL BLOCK
PENN STATE COURSES (18.0 credits)

Course	No.	Short Title	C.H.	Grade
NFMT	311	Matls, Safety & Equip	3.0	
NFMT	312	Basic Nanofab Processes	3.0	
NFMT	313	Thin Film Utilization	3.0	
NFMT	314	Advanced Litho	3.0	
NFMT	315	Matls Mod in Nano	3.0	
NFMT	316	Charac, Pack & Test	3.0	

Nanofabrication Manufacturing Technology (NFMT) Capstone Semester at Penn State University. **Note:** Students pay MU tuition and a fee ($2500 as of October 2015) to Penn State.

REQUIRED RELATED (22.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

Course	No.	Short Title	C.H.	Grade
PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

General Electives (as necessary)

BACHELOR OF SCIENCE IN CHEMISTRY
NANOTECHNOLOGY OPTION
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. of Speech	3.0
ENGL	110	English Composition	3.0	CHEM	251	Inorganic I	3.0
		TOTAL S.H.	12.0			*TOTAL S.H.*	14.0
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
		TOTAL S.H.	13.0			*TOTAL S.H.*	14.0

SUMMER (18.0)

Nanofabrication Courses at Penn State University

		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	312	Chem in Nanotechnology	3.0	CHEM	342	Physical Chem II	4.0
CHEM	341	Physical Chem I	4.0	ENGL	312	Technical Writing	3.0
_____	____	Humanities Course #1	3.0	_____	____	Humanities Course #2	3.0
_____	____	Social Sciences Course #1	3.0	_____	____	Social Science Course #2	3.0
		TOTAL S.H.	13.0			*TOTAL S.H.*	13.0
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	487	Seminar in Chemistry I	0.5	CHEM	488	Seminar in Chemistry II	0.5
CHEM	498	Intro to Research (Required)	1.0	_____	____	Perspectives Course	3.0
CHEM	498	Chemistry Elective	1.0	_____	____	C&E Course #1	3.0
CHEM	____	Chemistry Elective	4.0	_____	____	C&E Course #4	3.0
_____	____	Humanities Course #3	3.0	WELL	175	Wellness	3.0
_____	____	Social Science Course #3	3.0			*TOTAL S.H*	12.5
		TOTAL S.H.	12.5				

COMMENTS, NOTES OR RECOMMENDATIONS:

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended.
7/10

Back to Table of Contents

BACHELOR OF SCIENCE IN CHEMISTRY/OPTION IN POLYMER CHEMISTRY

Polymer chemistry has become such an important area of the chemical industry that it is estimated that 50% of all chemists will work in polymer chemistry in some capacity during their careers. Polymer chemistry forms the basis for the production of plastics, synthetic fibers, paints, coatings, adhesives, and many other chemical products. Although most polymer chemists are employed by industry, there are also jobs available in academics and in the government.

When biochemistry is chosen as a chemistry elective, the curriculum for a B.S. Chemistry degree with an option in Polymer Chemistry satisfies the guidelines of an option in polymer chemistry set forth by the American Chemical Society Committee on Professional Training. The Department of Chemistry is currently initiating the process of having the option certified by the American Chemical Society.

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE: BS
MAJOR: CHEM
OPTION: POLY

MAJOR REQUIREMENTS FOR A BS DEGREE IN POLYMER CHEMISTRY
Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the of sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **POLYMER**
Major Field Requirements: **59.0 Credits**
Other Requirements: **22.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (48.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	381	Polymer Chem I	4.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	465	Analytical Chem	4.0	
CHEM	482	Polymer Chem II	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Independent Study	1.0	

CHEMISTRY & RELATED ELECTIVES (min 11.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	312	Chem in Nanotech	3.0	
CHEM	324	Plant Biochemistry	4.0	
CHEM	326	Biochemistry I	4.0	
CHEM	327	Biochemistry II	4.0	
CHEM	328	Analyt. Biochem Lab	1.0	
CHEM	375	Environmental Chem	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	476	Environmental Chem II	4.0	
CHEM	486	Topics in Chemistry	1.0-4.0	
CHEM	498	Independent Study	1.0-3.0	
CHEM	489	Dept. Honors	1.0-3.0	
CHEM	499	Dept. Honors	1.0-3.0	
CHEM	300	Cooperative Educ	3.0-6.0	
CHEM	400	Cooperative Educ	3.0-6.0	
ITEC	271	Proc. Non-Met. Mater.	3.0	
ITEC	375	Poly & Ceramic Tech	3.0	

REQUIRED RELATED (22.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

Course	No.	Short Title	C.H.	Grade
PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Suggested general education courses:
BUAD 101, BUAD 161, ECON 101, ECON 102, and two foreign language courses (101 and 102).

General Electives (as necessary)

BACHELOR OF SCIENCE IN CHEMISTRY
POLYMER CHEMISTRY OPTION
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. of Speech	3.0
ENGL	110	English Composition	3.0	CHEM	251	Inorganic I	3.0
_____	____	Social Sciences Course #1	3.0	_____	____	Social Sciences Course #2	3.0
		TOTAL S.H.	15.0			*TOTAL S.H.*	17.0
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
WELL	175	Wellness	3.0	_____	____	Humanities Course #1	3.0
		TOTAL S.H.	16.0			*TOTAL S.H.*	16.0
		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	381	Polymer Chemistry I	4.0	CHEM	482	Polymer Chem II	3.0
_____	____	Humanities Course #2	3.0	_____	____	Humanities Course #3	3.0
ENGL	312	Technical Writing	3.0	_____	____	Social Sciences Course #3	3.0
		TOTAL S.H.	14.0			*TOTAL S.H.*	13.0
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	452	Inorganic II	3.0	CHEM	465	Analytical Chemistry	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	488	Chemistry Seminar	0.5
CHEM	498	Intro to Research	1.0	CHEM	____	Chemistry Elective*	4.0
CHEM	____	Chemistry Elective*	4.0	ITEC	271	Proc Non-Met Materials	3.0
_____	____	Perspectives Course	3.0	_____	____	C&E Course #4	3.0
_____	____	C&E Course #1	3.0			*TOTAL S.H.*	14.5
		TOTAL S.H.	14.5				

COMMENTS, NOTES OR RECOMMENDATIONS:

* Students opting for ACS Certification in Polymer Chemistry should take Biochemistry I (CHEM 326).

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 101 or 102, for example) and an Introductory Business Administration course (BUAD 101 or 161, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives. ENGL 312 (Technical Writing) is highly recommended.

11/10

Back to Table of Contents

BACHELOR OF SCIENCE IN CHEMISTRY / OPTION IN ENGINEERING INSTRUMENTATION AUTOMATION

Chemical analysis and instrumentation plays an important role in modern chemistry. Automation of the control of instruments is increasingly being accomplished using robotics. Students who both understand chemistry and robotics will be well-prepared to not only use instruments to analyze chemical samples, but also to troubleshoot, modify, and design new instrumentation controls.

The B.S. Chemistry degree with an option in Engineering Instrumentation Automation is focused on using, controlling, and improving instruments for chemical analysis and interpreting/analyzing data. Many chemistry employment opportunities exist in analytical laboratories or graduate school where sophisticated instrumentation is used extensively. This option maintains a core chemistry curriculum and supplements the chemistry knowledge content with industrial electronics, control systems, and robotics. This option is a unique learning experience available at Millersville due to the collaboration of the Department of Chemistry and the Department of Applied Engineering Safety and Technology. Graduate of this option will be well prepared for positions where instrumentation and analysis plays a key role.

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS CHEMISTRY DEGREE IN ENGINEERING**
MAJOR:	CHEM	**INSTURMENTATION AUTOMATION**
OPTION:	EIA	Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the of sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111, 112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

Note to the Student: *This form is provided as a guide. IT is your responsibility to consult regularly with your advisor to be aware of change and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **Engineering Instrumentation Automation**
Major Field Requirements: **47.0 Credits**
Other Requirements: **34.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (39.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	465	Analytical Chem	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Research	1.0	

Electives (8.0 credits)

Course	No.	Short Title	C.H.	Grade
CHEM	300	Co-op in Chem	3.0	
CHEM	312	Chem in Nanotech	3.0	
CHEM	326	Biochemisty I	4.0	
CHEM	327	Biochemistry II	4.0	
CHEM	328	Analytical Biochemistry	1.0	
CHEM	375	Environmental Chem	4.0	
CHEM	381	Polymer Chem I	4.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	400	Co-Op in Chem	3.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	476	Enivornmental Chem II	4.0	
CHEM	482	Polymer Chem II	3.0	
CHEM	486	Topics in Chem	1.0-4.0	
CHEM	489	Dept. Honors	1.0-3.0	
CHEM	498	Independent Study	1.0-3.0	
CHEM	499	Dept. Honors	1.0-3.0	

REQUIRED RELATED (34.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

Course	No.	Short Title	C.H.	Grade
PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Control Systems (12.0 credits)

Course	No.	Short Title	C.H.	Grade
ITEC	261	Electronic Systems	3.0	
ITEC	325	Pwr Conversion and Ctrl	3.0	
ITEC	425	Industrial Robotic Sys.	3.0	
ITEC	427	Prog. Logic Controllers	3.0	

BACHELOR OF SCIENCE IN CHEMISTRY ENG. INST. AUTOMATION OPTION
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. of Speech	3.0
ENGL	110	English Composition	3.0	CHEM	251	Inorganic I	3.0
WELL	175	Wellness	3.0			*TOTAL S.H.*	14.0
		TOTAL S.H.	15.0				
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I	5.0	PHYS	232	Physics II	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
_____	___	Social Sciences Course #1	3.0	ITEC	261	Electronic Systems	3.0
		TOTAL S.H.	16.0			*TOTAL S.H.*	16.0
		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	391	Advanced Lab I	1.0	ITEC	425	Industrial Robotic Systems	3.0
_____	_____	Humanities Course #1	3.0	_____	_____	Perspectives Course	3.0
ITEC	325	Pwr. Conversion & Ctrl	3.0	_____	_____	Humanities Course #2	3.0
ENGL	3XX	Advanced Writing	3.0	_____	_____	C & E Course #1	3.0
		TOTAL S.H.	14.0			*TOTAL S.H.*	16.0
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	___	Chemistry Elective	4.0	CHEM	465	Analytical Chemistry	4.0
CHEM	487	Chemistry Seminar	0.5	CHEM	488	Chemistry Seminar	0.5
CHEM	498	Intro to Research	1.0	CHEM	_____	Chemistry Elective	4.0
ITEC	427	Prog. Logic Controllers	3.0	_____	_____	Social Sciences Course #3	3.0
_____	_____	Humanities Course #3	3.0	_____	_____	C & E Course #4	3.0
_____	_____	Social Sciences Course #2	3.0			*TOTAL S.H*	14.5
		TOTAL S.H.	14.5				

COMMENTS, NOTES OR RECOMMENDATIONS:

3. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
4. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

The American Chemical Society (ACS) and the Chemistry Department strongly recommend an Introductory Economics course (ECON 100, for example) among the Social Science (G3) electives and Elementary Foreign Language (FORL 101 and 102) among the Humanities (G1) electives.

Back to Table of Contents

BACHELOR OF SCIENCE IN CHEMISTRY / 3+4 PRE-PHARMACY OPTION

The 3+4 Pre-Pharmacy option is designed within the B.S. Chemistry program, allowing students to complete both B.S. Chemistry and Doctor of Pharmacy degrees in seven years. Students will be admitted into this program by Millersville University and complete a 3-year program in the Chemistry department that includes all courses required in the first three years (101.0 credits) of a B.S. chemistry degree. To remain in the program, each student must maintain an overall GPA of 3.0 as well as a science GPA of 3.0 at Millersville University. The students will then enroll in a 4-year Pharm. D. degree program at the pharmacy school of their choice. Upon successful completion of the first-year pharmacy program coursework, the chemistry department will accept a professional block of 19.0 credits from the pharmacy school. The 120.0 total credits earned will be the basis for awarding a B.S. chemistry degree from Millersville University, provided the student has completed all other requirements.

Should students not complete their first year in the pharmacy program, they will have to change their option in the chemistry degree and complete the requirements to fulfill a B.S. Chemistry (19.0 credits) at Millersville University. These credits in the chemistry degree will vary depending on the program to which they change (ex. B.S. Biochemistry or other B.S. options).

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE:	BS	**MAJOR REQUIREMENTS FOR A BS DEGREE IN**
MAJOR:	CHEM	**CHEMISTRY**
OPTION:	3+ 4 PRE-PHARM	Total credit hours required: 120 minimum

REQUIREMENTS AND POLICIES FOR THE BS CHEMISTRY MAJOR, 3+4 PRE-PHARMACY OPTION

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to maintain an overall 3.00 grade point average and a science 3.00 grade point average. If not, it is recommended that courses be repeated to meet the requirement or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.
2. Completion of this degree is dependent on student admission to a 4-year Pharm. D. degree program and successful completion of the first year pharmacy program coursework.
3. Students who do not successfully complete the first year coursework in a pharmacy program will have to change their option in the Chemistry degree and complete the requirements for that degree program at Millersville University.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BS CHEMISTRY**
Option: **3 + 4 PRE-PHARMACY**
Major Field Requirements: **37.0 Credits**
Other Requirements: **64.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (33.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	
CHEM	498	Research	1.0	

CHEMISTRY ELECTIVES (4.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	300	Co-op in Chem	3.0	
CHEM	375	Environmental Chem	4.0	
CHEM	381	Polymer Chemistry I	4.0	
CHEM	391	Advanced Lab I	1.0	
CHEM	392	Advanced Lab II	1.0	
CHEM	435	Advanced Organic Chem	3.0	
CHEM	452	Inorganic Chem II	3.0	
CHEM	465	Analytical Chem	4.0	
CHEM	486	Topics in Chemistry	1-4	
CHEM	489	Department Honors	1-3	
CHEM	498	Independent Study	1-3	
CHEM	499	Department Honors	1-3	

1st Year Pharmacy School COURSES (19.0)

REQUIRED RELATED (28.0 credits)

Mathematics (15.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	
MATH	235	Survey of Statistics	3.0	

Physics (10.0 credits)

Course	No.	Short Title	C.H.	Grade
PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Biology (3.0 credits)*

Course	No.	Short Title	C.H.	Grade
BIOL	100	General Biology	3.0	

***Note:** grade requirement (B- or better)

BACHELOR OF SCIENCE IN CHEMISTRY
3 + 4 PRE-PHARMACY OPTION
RECOMMENDED PROGRAM

FIRST SEMESTER				SECOND SEMESTER			
CHEM	111	Intro Chem I.	4.0	CHEM	112	Intro Chem II	4.0
UNIV	103	Chemistry Freshman Seminar	3.0	MATH	211	Calculus II	4.0
MATH	161	Calculus I	4.0	COMM	100	Fund. Of Speech	3.0
ENGL	110	English Composition	3.0	CHEM	251	Inorganic I	3.0
MATH	235	Survey of Statistics	3.0	_____	___	Humanities Course #1	3.0
		Total S.H.	17.0			*Total S.H.*	17.0

THIRD SEMESTER				FOURTH SEMESTER			
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
PHYS	231	Physics I w/ Calculus	5.0	PHYS	232	Physics II w/ Calculus	5.0
MATH	311	Calculus III	4.0	CHEM	265	Quant. Analysis	4.0
CHEM	___	Chemistry Elective	4.0	CHEM	498	Intro to Research (Req)	1.0
				_____	___	Soc. Science Course #1	3.0
		Total S.H.	17.0			*Total S.H.*	17.0

FIFTH SEMESTER				SIXTH SEMESTER			
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	487	Seminar in Chem I	0.5	CHEM	488	Seminar in Chem II	0.5
_____	___	Humanities Course #2	3.0				
_____	___	Soc. Science Course #2	3.0	ENGL	312	Technical Writing	3.0
_____	___	Perspectives and Diversity Course	3.0	BIOL	100	General Biology	3.0
WELL	175	Wellness	3.0			Humanities Course #3	3.0
				_____	___	Soc. Science Course #3	3.0
		Total S.H.	16.5			*Total S.H.*	16.5

PHARMACY SCHOOL (19.0)

SEVENTH SEMESTER			EIGHTH SEMESTER		
_____	___		_____	___	___
_____	___		_____	___	___
_____	___		_____	___	___
_____	___		_____	___	___

COMMENTS, NOTES OR RECOMMENDATIONS:

1. Students must successfully complete the above courses with a minimum of "C" for each course, an overall GPA of 3.0, a science GPA of 3.0 (on a 4.0 scale), and adhere to all University policies.
2. To satisfy the three W courses requirement, one of the Gen Ed courses needs to be a writing course.
3. Courses in Psychology, Sociology, Economics, and Ethics are strongly recommended.

Back to Table of Contents

BACHELOR OF SCIENCE IN SECONDARY EDUCATION/CHEMISTRY

The BSE-CHEM degree leads to certification to teach chemistry at the secondary level in the public schools of the Commonwealth of Pennsylvania. The BSE-CHEM requires Environmental Chemistry (CHEM 375) and requires at least one elective chemistry course. A student majoring in this program would be wise to take both CHEM 391 and CHEM 326 (Biochemistry I), as well as a foreign language at the elementary level. The Praxis Exam contains questions on material that is covered in CHEM 326.

MILLERSVILLE UNIVERSITY
Professional Education Unit
Conceptual Framework - Abstract

A Community of Learners building a future through inquiry & action, using exemplary practices & focusing on Students

1. **Learning Communities of Inquiry and Action:** We will engage in learning communities in which reflection, collaboration, lifelong learning, and habits of mind are developed and nurtured.

2. **Focus on Students:** We will balance knowledge and the principles and concepts delineated in professional and state standards with an appreciation of all students' individuality, diversity, and cultures.

3. **Exemplary Professional Practices:** We will demonstrate the knowledge, skills, and dispositions of exemplary professionals. We will have strong competence in our content knowledge, pedagogical content knowledge and skills as delineated in professional, state, and institutional standards. We will demonstrate professional dispositions or standards of conduct, will be supportive of students, families, and the school and community, and will serve as catalysts for positive and responsible change.

The Professional Dispositions of all of our Candidates are supported & continuously assessed by the Professional Education Unit. If these Dispositions are found to be less than proficient, programs may require evidence of successful remediation before an individual is permitted to progress.

To view the full text of the Conceptual Framework & Dispositions Guidelines, visit the School of Education web page linked to MU's home page.

The BSE Chemistry curriculum requires 126 semester hours minimum to qualify for graduation.

These courses need to be taken in a certain sequence, to satisfy pre-requisites. Not doing so can delay graduation by one or more semesters, as previous students have discovered. In order to plan correctly, students need to consult with their chemistry department advisor to create a program of study, which both satisfies pre-requisites and schedules each course during the semester when they plan to take it.

In addition, students need to consult with Dr. Nanette Marcum-Dietrich (nanette.dietrich@millersville.edu Educational Foundations Department, Stayer Hall, 871-7325) to be certain that requirements to become an educator are satisfied, including each course in the correct sequence and during the semester it will be offered. Students need to make both contacts in advance of fall registration so that they can complete that registration in a timely manner.

The chemistry faculty/advisors will keep track of students having made both contacts to ensure timely graduation.

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Student Name: Student I.D. #:

DEGREE: BSE

MAJOR: CHEM

OPTION:

MAJOR REQUIREMENTS FOR A BSE DEGREE IN CHEMISTRY

Total credit hours required: 126 minimum

REQUIREMENTS AND POLICIES FOR THE BSE CHEMISTRY MAJOR

A. Policies for Admission to the Major

1. New students (freshmen and transfers) must be admitted to the Chemistry major by the Office of Admissions upon admission to the University.
2. Admission into the Chemistry major from other departments is upon approval of the chairperson of the Chemistry Department.
3. Non-degree and continuing education students must be admitted to the Chemistry major by the Office of Admissions.

B. Policies for Retention in the Major

1. University requirements for retention.
2. The student is required to have a 2.00 grade point average in the major courses by the end of the of sophomore year. If not, it is recommended that courses be repeated to achieve a 2.00 average in the major or that there be a change of major.
3. Chemistry majors are required to have a 2.00 grade or better in Chemistry courses required for the major at the 100 and 200 level before proceeding to a new course for which it is a prerequisite. (Currently, these courses include: CHEM 111,112, 231, 232, 251, and 265).

C. Policies for Completion of the Major

1. Completion of all University curricular requirements.

D. Admission to Advanced Professional Studies and Certification (Ed. Majors)

All students enrolled in teacher preparation programs must be admitted to Advanced Professional Studies and meet Pennsylvania State requirements and university requirements prior to being enrolled in their initial Advanced Professional Studies course. Students must meet additional Pennsylvania State requirements in order to be certified. A listing of Advanced Professional Studies courses and requirements is available in each department office, the Early Field Experience office, and on the Early Field Experience website.

Note to the Student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

Back to Table of Contents

MAJOR SEQUENCE AND DEGREE REQUIREMENTS

Major: **BSE CHEMISTRY**
Option:
Major Field Requirements: **41.0 Credits**
Other Requirements: **55.0 Credits**

When applicable, up to six of the **REQUIRED RELATED** courses may be credited toward the Liberal Arts Core subject to normal distribution rules.

REQUIRED CHEMISTRY COURSES (41.0 Credits)

Course	No.	Short Title	C.H.	Grade
CHEM	111	Intro Chemistry I	4.0	
CHEM	112	Intro Chemistry II	4.0	
CHEM	188	Freshman Seminar	1.0	
CHEM	231	Organic Chem I	4.0	
CHEM	232	Organic Chem II	4.0	
CHEM	251	Inorganic Chem I	3.0	
CHEM	265	Quant Analysis	4.0	
CHEM	326	Biochemistry I	4.0	
CHEM	341	Physical Chem I	4.0	
CHEM	342	Physical Chem II	4.0	
CHEM	375	Environmental Chem	4.0	
CHEM	487	Seminar in Chem I	0.5	
CHEM	488	Seminar in Chem II	0.5	

PROFESSIONAL EDUCATION (33.0 Credits)

Course	No.	Short Title	C.H.	Grade
EDFN	211	Found. Modern. Ed.	3.0	
EDFN	241	Psyc. Found. Teach.	3.0	
EDSE	321	Issues in Sec. Educ.	3.0	
EDFN	330	Instr. Techn. Design	3.0	
EDSE	340	Cntnt. Area Litrcy Divers. Class	3.0	
SPED	346	Sec. Stdns. w. Disab. Inclu. Sttgs.	3.0	
EDSE	435	Teaching Science	3.0	
EDSE	461	Student Teaching	9.0	
EDSE	471	Different Instr. in Class	3.0	

REQUIRED RELATED (22.0 credits)

Mathematics (12.0 credits)

Course	No.	Short Title	C.H.	Grade
MATH	161	Calculus I	4.0	
MATH	211	Calculus II	4.0	
MATH	311	Calculus III	4.0	

Physics (10.0 credits)

Course	No.	Short Title	C.H.	Grade
PHYS	231	Physics I with Calc	5.0	
PHYS	232	Physics II with Calc	5.0	

Biology

Demonstrate competency in Biology 100*

*Competency may be demonstrated by one of the following:
1) a course grade of "A" or "B" in AP Biology
2) a score of 3 or better in the national AP exam
3) a successful score on the CLEP exam
4) a passing grade for General Biology (BIOL 100)

General Education Perspectives requirement not required for BSE majors declared as of Fall 2006

General Electives (as necessary)

Back to Table of Contents

BACHELOR OF SECONDARY EDUCATION IN CHEMISTRY
RECOMMENDED PROGRAM

		FIRST SEMESTER				**SECOND SEMESTER**	
CHEM	111	Intro Chem I	4.0	CHEM	112	Intro Chem II	4.0
CHEM	188	Freshman Seminar	1.0	CHEM	251	Inorganic Chem I	3.0
ENGL	110	English Composition	3.0	COMM	100	Fund. of Speech	3.0
MATH	161	Calculus I	4.0	_____	_____	Humanities Course #1	3.0
WELL	175	Wellness Course	3.0	MATH	211	Calculus II	4.0
		TOTAL S.H.	15.0			*TOTAL S.H.*	17.0
		THIRD SEMESTER				**FOURTH SEMESTER**	
CHEM	231	Organic I	4.0	CHEM	232	Organic II	4.0
_____	_____	Social Sciences Course #1	3.0	CHEM	265	Quant. Analysis (or G1) *	4.0
MATH	311	Calculus III	4.0	PHYS	232	Physics II w/ Calculus	5.0
PHYS	231	Physics I w/ Calculus	5.0	EDFN	211	Found Modern Ed	3.0
_____	_____	Humanities Course #2	3.0	EDFN	241	Psych Fnd Tchg	3.0
		TOTAL S.H.	19.0			*TOTAL S.H.*	19.0
		FIFTH SEMESTER				**SIXTH SEMESTER**	
CHEM	341	Physical Chem I	4.0	CHEM	342	Physical Chem II	4.0
CHEM	375	Environ Chem (D)	4.0	CHEM	488	Chemistry Seminar	0.5
CHEM	487	Chemistry Seminar	0.5	ENGL	3XX	Advanced Writing ***	3.0
EDSE	340	Cntnt. Area Litr. Diver.Class	3.0	_____	_____	Humanities Course #3	3.0
SPED	346	Sec.Stdnts w Disab.Incl.Sttgs	3.0	_____	_____	Social Sciences Course #3	3.0
_____	_____	Social Sciences Course #2	3.0			*TOTAL S.H.*	13.5
		TOTAL S.H.	17.5				
		SEVENTH SEMESTER				**EIGHTH SEMESTER**	
CHEM	326	Biochemistry I **	4.0	EDSE	461	Student Teaching	9.0
EDFN	321	Issues in Secondary Ed	3.0	EDSE	471	Different Instr. in Class	3.0
EDFN	330	Instructional Technology	3.0			*TOTAL S.H.*	12.0
EDFN	435	Teaching Science	3.0				
		TOTAL S.H.	13.0				

COMMENTS, NOTES OR RECOMMENDATIONS:

* It is recommended that CHEM 265 (or a G1 course) be taken during the summer session prior to CHEM 341.

** It is highly recommended that you take CHEM 326 because the Praxis exam contains questions from the material covered in biochemistry.

*** ENGL 312 (Technical Writing) is highly recommended.

1. Connections & Exploration (C&E) courses #1 and #4 can be satisfied with any approved GenEd course.
2. Cultural Diversity & Community (D) course may be satisfied with approved courses from the GenEd requirements (including Perspectives), the major, the minor, the required related area, or general electives.

Note 1: The BSE-Chemistry curriculum as a whole satisfies the Perspectives (P) requirement in the general education curriculum. This means that BSE-Chemistry majors do not need to take a perspectives course to satisfy this requirement.

Note 2: The Pennsylvania Dept. of Education requires 6 credits of English; 3 in writing and 3 in literature. Therefore, each BSE student MUST take 3 credits of writing (ENGL 110 meets this requirement) AND 3 credits of literature in the English Dept. A "G1" English literature course fulfills this requirement. This is a prerequisite requirement and MUST be completed before you can do Junior Block and Student Teaching.

8/17

Back to Table of Contents

MILLERSVILLE UNIVERSITY

Curriculum Record Form for an Academic Minor in Chemistry

Minor: **CHEMISTRY** Total credit hours required: 20.0 minimum

Department: Chemistry

Regulations Governing Minor Course Work

1. There shall be a minimum of 20.0 credit hours with a minimum Millersville QPA of 2.0.
2. Only one course which counts toward your major may be counted toward your minor.
3. Courses that count toward a minor are also eligible to be used to satisfy the current University-wide General Education requirements subject to normal distribution requirements.
4. At least two courses should be at the upper-division level (300-400). Exceptions may be requested upon evidence of program depth.
5. No course needed for the minor may be taken Pass-Fail.
6. One-half of the work required for the minor must be completed at Millersville University.
7. No student may minor in his or her major.

Course No.		Short Title	C.H.	Q.P
Required Chemistry Courses (16.0 - 20.0 Credits)				
CHEM	111	Intro to Chemistry I	4.0	
CHEM	112	Intro to Chemistry II	4.0	
CHEM	265	Quant. Analysis	4.0	
Chose one of the following three groupings:				
CHEM	235	Organic Chemistry	4.0	
	or			
CHEM	231	Organic Chemistry I	4.0	
CHEM	232	Organic Chemistry II	4.0	
	or			
CHEM	341	Physical Chemistry I	4.0	
CHEM	342	Physical Chemistry II	4.0	

Course No.		Short Title	C.H.	Q.P
Chemistry Electives (0.0-4.0 credits)				
CHEM	326	Biochemistry I	4.0	
CHEM	375	Environmental Chem	4.0	

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MILLERSVILLE UNIVERSITY

Curriculum Record Form for an Academic Minor in Chemistry

Minor: **BIOCHEMISTRY** Total credit hours required: 25.0 minimum

Department: Chemistry

Regulations Governing Minor Course Work

1. There shall be a minimum of 25.0 credit hours with a minimum Millersville QPA of 2.0.
2. Only one course which counts toward your major may be counted toward your minor.
3. Courses that count toward a minor are also eligible to be used to satisfy the current University-wide General Education requirements subject to normal distribution requirements.
4. No course needed for the minor may be taken Pass-Fail.
5. One-half of the work required for the minor must be completed at Millersville University.
6. No student may minor in his or her major.

Course No.		Short Title	C.H.	Q.P
Required Chemistry Courses (25.0 Credits)				
CHEM	111	Intro to Chemistry I	4.0	
CHEM	112	Intro to Chemistry II	4.0	
CHEM	231	Organic Chemistry I	4.0	
CHEM	232	Organic Chemistry II	4.0	
CHEM	326	Biochemistry I	4.0	
CHEM	324	Plant Biochemistry	4.0	
	or			
BIOL	324	Plant Biochemistry	4.0	
	or			
CHEM	327	Biochemistry	4.0	
	and			
CHEM	328	Analytical Biochem Lab	1.0	

Course No.		Short Title	C.H.	Q.P
Chemistry Electives (0.0-4.0 credits)				
		RECOMMENDED COURSE		
CHEM	265	Quantitative Analysis	4.0	

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

MILLERSVILLE UNIVERSITY

Curriculum Record Form for an Academic Minor in Chemistry

Minor: **ENVIRONMENTAL CHEMISTRY** Total credit hours required: 20.0 minimum

Department: Chemistry

Regulations Governing Minor Course Work

1. There shall be a minimum of 20.0 credit hours with a minimum Millersville QPA of 2.0.
2. Only one course which counts toward your major may be counted toward your minor.
3. Courses that count toward a minor are also eligible to be used to satisfy the current University-wide General Education requirements subject to normal distribution requirements.
4. No course needed for the minor may be taken Pass-Fail.
5. One-half of the work required for the minor must be completed at Millersville University.
6. No student may minor in his or her major.
7. At least two courses should be at the upper-division level (300-400). Exceptions may be requested upon evidence of program depth.

Course No.	Short Title	C.H.	Q.P
Required Chemistry Courses (20.0-24.0 Credits)			
CHEM 111	Intro to Chemistry I	4.0	_____
CHEM 112	Intro to Chemistry II	4.0	_____
CHEM 375	Environmental Chem I	4.0	_____
CHEM 476	Environmental Chem II	4.0	_____
CHEM 231	Organic Chemistry I	4.0	_____
CHEM 232	Organic Chemistry II	4.0	_____
or			
CHEM 235	Organic Chemistry	4.0	_____

Course No.	Short Title	C.H.	Q.P
Chemistry Electives (0.0-4.0 credits)			
CHEM 265	Quantitative Analysis	4.0	_____

Note to the student: *This form is provided as a guide. It is your responsibility to consult regularly with your advisor to be aware of changes and curriculum details which are not incorporated on this form.*

Back to Table of Contents

INTERNSHIPS

Internships are available to various majors at Millersville University. In chemistry the program has been an on-going one since 1975. It is a learning approach that interweaves college studies with alternating cycles of working—experience in business, industry, or government. The Department of Chemistry has had students placed in a variety of chemistry-related jobs in industry, locally and throughout the southeastern Pennsylvania region. Thus, the student acquires invaluable practical experience in chemistry prior to obtaining a degree. As a result, the student upon graduation is more knowledgeable about his/her chosen career, is nearly always more committed and motivated, and is more employable because of the experience gained. Also, students earn a salary which defrays a large percentage of the cost of the college education. Further, academic credit is awarded for the experience that can be counted toward normal graduation requirements.

Participating chemistry majors must have completed at least three semester of study before applying for an internship and thereafter would normally alternate semesters of work and study until graduation. These are arranged by the University Office of Experiential Learning and Career Management in cooperation with the Department Coordinator. It helps to have a good quality point average, although some of our best interns have been ones who started the program with marginal academic performance, got 'turned on' by the experience, and markedly improved their academic performance. Most of the jobs are competitive in the sense that the student is in competition for the internship with students from other colleges and universities. Thus, preparing a resume and learning how to interview are other important advantages that an internship student acquires. The student is evaluated during the experience both by the intern supervisor and by the faculty coordinator. Please see the Department Coordinator for further details of the program and consider 'interning' very seriously as a viable adjunct to your undergraduate education.

GRADUATION

Graduation requirements are fully detailed in the University Catalog and elsewhere in this handbook. To avoid unpleasant surprises, each student should consult with his/her faculty advisor to develop a program of study that will insure that all requirements are met in a timely fashion. This program of study should be reviewed, and revised if necessary, at the time of each preregistration conference. Please note that a QPA of 2.00 **in the major** (as well as overall) is required for graduation.

Early in the semester of graduation, the prospective student is required to submit an application for graduation. The student has the primary responsibility to make sure that all graduation requirements have been met and that all information on this application is correct. The student's advisor signs the application, certifying that all requirements for graduation will be satisfied by the end of the semester. Only then does the Department Chairperson sign, certifying that both student and advisor have discharged their responsibilities. Please do not rely on the Department Chairperson to check graduation requirements, since there simply are too many graduates each year to enable the chairperson to always perform that task as efficiently as he/she would like. It is strongly recommended that students meet with their advisor the semester **prior** to the semester of graduation to ensure that all graduation requirements and QPA have been fulfilled.

Each department is responsible for an Outcomes Assessment Report. The Chemistry Department has chosen two tools to evaluate our program. The graduating seniors will be asked to take the Multiple Field Assessment Test (MFAT) and to complete a brief exit interview. Both of these assessment tools will be part of the senior seminar course (CHEM 488). The Department will use this information for the Middle States Accreditation, for the ACS 5-year Program Review and for the in-house Program Review process.

SEMINAR POLICY

During the academic year, the Chemistry Department schedules seminars nearly every week of each semester. Seminars are usually presented at 4:00 p.m. on Monday in the Engle Lecture Hall, Roddy 149. Seminar speakers come from various sources. During the fall semester, the Department arranges for speakers to come from various graduate schools. These chemistry faculty members generally speak about their research and provide us with an opportunity to learn about current work in chemistry. The primary purpose of these visitors is to attract our graduates to attend their graduate schools, and thus, they usually are available for interviews with students during the day. If you have any plans for graduate work, please interview as many of these faculty members as possible; this will give you valuable information about graduate study in general. During the fall semester, the Student Chapter of the American Chemical Society also arranges for seminar speakers. These individuals often come from institutions with no graduate program. They often speak on a less specialized topic and usually do not interview students. However, some come from unusual professions (such as forensic chemistry) and will be available to answer questions about their jobs.

During the spring semester, most of the seminar speakers are senior Millersville Chemistry majors enrolled in Seminar, CHEM 488. Student seminar topics range from the research they have performed to subjects of general interest. It is important that the audience at these seminars be substantial so that the presenting student gains the experience of speaking to a group.

As a chemistry major, you are expected to attend all of the Monday seminars. The Department believes strongly that by doing so you will expand your horizons and learn something about chemistry that is not presented in the classroom. Your presence at seminars also gives you an opportunity to get to know all of the faculty as well as the other students majoring in chemistry. It gives you a sampling of the many different styles of speaking with the result that you should feel more comfortable when it becomes your turn to speak. In addition, announcements of items of interest to students (such as job availability) are made at the beginning of the seminar period.

Each seminar is announced at least one week in advance by a written notice posted throughout the building but always outside the Chemistry Department Office, Caputo Hall- Room 234. We hope you make seminar attendance a regular habit that will remain with you after you have graduated.

DEPARTMENT OF CHEMISTRY
Policy on Independent Study, Individualized Study, Introduction to Research, and Departmental Honors

I. Rationale

As described in the current catalog, the University recognizes five types of individualized course experiences that require special departmental approval.

a. Individualized Instruction (or "course by arrangement")
b. Independent Study, Chemistry 498
c. Honors Course
d. Departmental Honors Program
e. Introduction to Research, Chemistry 498

The Chemistry Department encourages participation in these experiences to the extent warranted by the student's motivation and preparedness, faculty availability, and to the extent afforded by budgetary limitations. In addition, each year research opportunities at other institutions become available on a competitive basis. Any students participating in one of these experiences may earn up to 4 s.h. (CHEM 498, 1 s.h.; CHEM 498, 1-3 s.h.). The Chair receives these invitations and makes the announcement either at Monday seminars or through e-mail. While these five programs are described in some detail in the University catalog, specific details of implementation are left to the Department. The Chemistry Department defines these terms as follows:

a. **Individualized Instruction** (or "course by arrangement") is available to a student under the special circumstances in which a course he/she needs, or is highly motivated to study, is not being offered during a given semester. It must be an established course within the existing curriculum, and it must be under the voluntary supervision of a qualified faculty member. Individualized instruction may be used to accelerate or facilitate a student's educational progress, but not merely to relieve a student of the consequences of poor past planning.

b. **Independent Study** serves the unique interest of an individual student by providing an opportunity for inquiry that is not available through an established course. It is created by the Chemistry Department as an extension (in either breadth or depth) of the existing curriculum and it usually is a perpetuation of a research project begun in CHEM 498 (Introduction to Research). Each independent study course is one semester in duration, although the student may apply for renewal. At the conclusion of the semester, the student must present an acceptable written or oral report to the Department.

c-d. **The Honors Course and the Departmental Honors Program** are described in detail in the University catalog. Both require the completion of a thesis and the Departmental Honors Program requires a final oral examination as well.

Back to Table of Contents

e. **Introduction to Research** is a required course for all majors in the Bachelor of Science Degrees (except the BSE degree). The student is expected to complete a laboratory research project under the supervision of a member of the chemistry faculty.

II. Academic Standards

In no case shall individualized instruction or independent study be used to ease the rigorous standards of the established academic curriculum. The faculty supervisor is totally responsible for assuring the academic integrity of the experience and awarding the final grade.

III. Procedures

a. Individualized instruction/independent study/honors/introduction to research may be initiated by either a student or a faculty member. After preliminary consultation between the student and the faculty supervisor to discuss the scope and nature of the proposed course of study, a formal request is filed with the Department Chairperson. The appropriate forms are available in the Department Office.

b. In order to ensure timely processing of the necessary administrative procedures, these forms must be submitted to the Department Chairperson **prior to the semester** in which the study is to take place. Renewals are subject to the same constraint.

c. The faculty supervisor will meet with the student on a regular basis throughout the semester.

d. The independent study student will present an appropriate written report at the end of the semester. This report will clearly summarize the achievements of the project.

e. Each semester, the Chairperson will provide the department with a summary, including the names of students and faculty involved and areas of study.

f. In order to receive credit for Introduction to Research (CHEM 498) and/or Independent Study (CHEM 498), the student **will submit a report** summarizing the work accomplished to the faculty supervisor. This report should be in the form of a journal article, suitable for publication. One copy will be filed in the Chemistry Department Office, and the other copy will be returned to the student after the supervisor has assigned a grade for the course. In addition, students are encouraged to present the results of their research at a student research conference, generally held off-campus.

Over the years, documentation referring to these experiences (the curriculum sheets, the university honors, the independent study sheets, and the Degree Audit) have all had small but significant changes. This is the present scenario:

1. If a student has not taken the required research credit for their program of study, whether they are in honors or not, they must sign up for CHEM 498 (1 credit) of required research.

2. If a student has had CHEM 498 and are in the Honors College:
    a. They must then take CHEM 489, 1-3 credit(s), in order to fulfill the honors requirement. This also registers the student for the honors thesis. It is recommended that they take this to finish any research on their project and to write the honors thesis. These credits count in the chemistry elective block.
    b. Students in the Honors College will also earn Departmental Honors so they should also sign up for CHEM 499 (1-3 credits) using a separate Request for Special Study Assignment form. This also counts in the chemistry elective block and registers them for Departmental Honors.
    c. Since students in the Honors College are writing a thesis the credits for CHEM 489 and 499 must add up to 3 credits. This is because the thesis counts for a 3 credit advanced writing course.

3. Students who are **not** in the Honors College and opt to do Departmental Honors only need to sign up for CHEM 499 in the chemistry elective block. Usually these students will have taken CHEM 498, which is required. In order to finish their research they will take additional credits in CHEM 498 in the elective block plus CHEM 499 in order to register for Departmental Honors.

Each of the options for CHEM 489, 498, and 499 must all have a separate Request for Special Study Assignment sheet which can be found at: http://www.millersville.edu/forms/ or in the Department Office. It works better at the Dean's level to spread these credits out over two to three semesters.

REQUIREMENTS FOR HONORS THESIS FOR DEPARTMENTAL HONORS

Establish an Honors Thesis Committee consisting of three members, one of whom is the student's research advisor. The remaining two members must consist of at least one other chemistry faculty member. All projects must be an original piece of research and must be accepted by the student's Honors Thesis Committee.

Laboratory Time and Literature Review Time

4 hours per week for each undergraduate credit (8/2 cr)

Each student should prepare a monthly schedule indicating which time slots will be devoted to laboratory work or related reading. This should be posted in the research lab.

Lab Notebook

An organized account of work done; includes dates, all details of preparations, results and comments. This will be periodically checked by the instructor.

Research Seminar

At the end of the semester, each student will present their results. Faculty and fellow students will be invited. Each presentation should include background information and clearly explain findings.

Scientific Paper

Each student will prepare a paper that is suitable for publication. Again, background information (introduction), results, and discussion must be included along with a detailed account of materials, methods, and literature cited.

Technique Evaluation

Near the end of the semester, each student will be asked to explain and demonstrate the methods used in his/her project. Understanding of techniques and laboratory dexterity will be evaluated.

All projects for the semester must be completed within 4 days of final exams – at least 2 days before grades are due. Incompletes cannot be granted unless the student is confined to a sick bed for more than a week prior to the due date or if there has been a death in the immediate family.

Each student is expected to keep the lab in immaculate condition and to share responsibility for cleaning pipettes, glassware and sterilizing them. Cooperation is essential.

LABORATORY SAFETY

Read and follow these rules and guidelines. Failure to do so will result in immediate ejection from the laboratory.

The laboratory chemist is exposed to a wide variety of risks and hazards. Accidents can and do happen. We can prevent or minimize the effect of a lab accident by using common sense, avoiding rushing our work, and following the common rules of laboratory safety, as outlined below.

Fundamental Rules

1. Learn the location and proper use of safety equipment, such as the eye wash, fire extinguisher, and safety shower.

2. **EYE PROTECTION MUST BE WORN AT ALL TIMES**. Goggles must be used except when other eyewear is approved by the instructor. Contact lenses are **STRICTLY FORBIDDEN** in the lab. Serious damage may be caused by trapping fumes or corrosive liquids under the lens.

3. **NEVER** perform unauthorized experiments.

4. **NEVER** work alone in the laboratory. Be sure someone is always nearby.

5. **NEVER** bring food or beverage into the lab.

6. **NEVER** smoke in the lab.

7. When pipetting, **always** use a bulb or other approved device. **NEVER** pipet by mouth.

8. Avoid contact with toxic or corrosive materials. If any gets into the eye or on the skin, wash immediately with large amounts of water. If a large amount of corrosive material gets on clothing, remove it quickly and wash the affected area. Modesty is not as important as safety when time is of the essence.

9. Attire: Wear adequate foot protection. Sandals or open-top shoes are not to be worn in lab. A lab coat or apron should be worn for protecting skin and clothing. Long hair must be tied back.

10. Avoid touching hot objects. Be careful and use a sign to designate that an object or hot plate is still warm, even if it is switched off.

11. When using or evolving toxic, caustic, or noxious gases, the work must be done in a **fume hood.**

12. Avoid smelling anything directly. Always use your hand to wave fumes toward the nose from a safe distance.

13. Always make provision for avoiding spattering during the heating of liquids. Never point a heated tube toward anyone and cover heated solutions with watch glasses or other appropriate items.

14. Dispose of chemicals and solutions directly. Never pour any liquid into the sink without first asking your instructor. Never put any solids in the sink, but use the solid waste container or trash can.

15. Broken glass is to be put into the waste container labeled for glass.

16. In case of an accident, notify your instructor immediately.

General Discussion – Laboratory Safety

It is important to understand the potential hazards facing you in the chemistry laboratory. Once you are familiar with the proper procedures and precautions for lab work, put them into action at all times. Remember to work efficiently but also to take your time. Most accidents are the result of the analyst's haste and unpreparedness. Come into lab prepared and do not rush!

Some Hazards in the Chemistry Laboratory

1. Chemical hazards
    a. Eye/skin contact
        i. Spattering, violent reactions
        ii. Spills
    b. By ingestion (mouth)
    c. By inhalation of gas, dust, or fumes
2. Fire hazards
    a. Volatile, flammable solvents
    b. Electrical sources or malfunctions
    c. Other
3. Carelessness
    a. Dropped or bumped objects
    b. Tripping over objects in aisles
    c. Cuts and spills
    d. Improper set up or use of tools
    e. Other

Chemical Hazards

EYES. Your eyes are not only virtually irreplaceable, but also very susceptible to injury. Two of the more common accidents that affect the eyes are the breakage of glass containers which may or may not contain dangerous materials and the chemical reaction that goes out of control. Both can cause glass or chemicals to be sprayed into the eyes and/or skin. For this reason eye protection **must** be worn at all times in the chemistry laboratory. In some cases the safety goggles must be removed in order to take a reading from a balance, buret, meter, etc. However, in a lab where more than one or two people are working this is not to be done without extreme caution, since a spill from another's work area can reach a person making a measurement. If the balances are in an area isolated from the lab bench, eye protection may be removed as long at the material to be weighed is 'safe'. If any chemical is sprayed into the eyes, **immediately** flood the eyes with water. All labs should have eye wash stations, but if one is not nearby, use the nearest cold water tap for quick flushing with copious volumes of water for at least 10 minutes.

SKIN. Two common types of injury to the skin may result from contact with certain chemicals:

1. Chemical burns, such as those from strong oxidants, acids or bases.

2. Absorption of certain compounds through skin. To avoid skin injury, all chemicals should be handled with care. Spills, even small ones, must be contained and cleaned up promptly. Lips of reagents bottles, especially those of dangerous materials should be wiped clean after each use so that no substance remains on the outside of the bottle waiting to contact the next hand that touches it. The hands, forearms, and elbows must be washed frequently when working around chemicals. Many accidents require the help of another person; therefore, never work alone in the laboratory. On numerous occasions in academic labs students who spill or splash irritants on skin or in eyes have to be helped to the wash station because they cannot see it or are in too much pain to act.

SWALLOWING. Absolutely NO FOOD OR DRINK IS TO BE BROUGHT INTO A LABORATORY! It is too easy to contaminate food, especially with traces from hands or vapors. In addition, you should never touch your mouth area with your fingers while working with chemicals. In order to avoid the possibility of swallowing chemical solutions, pipeting should be done using a rubber bulb or some other suitable device. NEVER PIPET BY MOUTH and never use your mouth for suction when starting a siphon.

INHALATION. Inhaling many fumes can irritate and damage lungs and mucous membranes. Some gases (e.g., HCN or H_2S) are extremely **toxic** and must be handled with great care. VOLATILE CHEMICALS OR THOSE THAT MIGHT GENERATE IRRITATING OR TOXIC FUMES MUST BE USED IN A LABORATORY FUME HOOD AND STORED IN A WELL-VENTILATED AREA. Some common examples include the heating of strong acid solvents during sample dissolving or glass cleaning, the use of concentrated ammonia, and the generation of noxious sulfur compounds when reacting sulfides with oxidants. Chemical dust may also be a hazard. Although solid chemicals usually exist in crystalline state, finely powdered substances can be inhaled deeply into the lungs as dust. Handle such solids in the hood.

Fire Hazards

VOLATILES. Fire in the laboratory can be extremely dangerous, especially when volatile, flammable substances are present. The presence of other materials that emit toxic gases on flames is also a serious concern. Wherever possible, less flammable solvents should be substituted for highly flammable ones like ethyl ether and low-boiling petroleum ether. At present, most heating is done with electric hot plates or mantles, but the following rule still is very important: NEVER WORK WITH A VOLATILE SOLVENT AROUND AN OPEN FLAME. In order to avoid accidental spills and reduce fire hazards, keep volatile solvents in small containers at the back of the lab bench. Volatile solvents should be stored in a vented cabinet designed for such materials.

ELECTRICAL MALFUNCTIONS. Frayed electrical cords or poor connections can cause electric shock and/or fire. Inspection of electrical equipment for possible hazards should be done periodically.

OTHER SOURCES. Those hazards described above represent the most commonly encountered lab accidents involving fire. Other sources exist, such as bad lab habits and improper disposal of matches or other combustibles. In general, one must use common sense and exercise caution at all times.

Careless Habits

HANDLING GLASS TUBING. Cuts from the careless handling of glass tubing or equipment are among the most frequent accidents in the laboratory. When inserting tubing through a stopper, always use gloves or toweling. Never force tubing through an opening with your bare hands.

FALLING OBJECTS. Serious injury usually results when an object falls from a shelf or bench. NEVER PLACE HEAVY OBJECTS ON HIGH SHELVES. If a heavy object must be put on a shelf, secure it with a belt or chain. Cylinders of compressed gas also must be secured with a proper belt or chain. Always be careful when moving heavy objects. Use a cart or moving equipment.

PERSONAL HABITS. Avoid standing on lab stools. A common example is that of a student trying to read a buret by standing on a stool. Many times, a serious fall or accident results from this practice. Instead of using a stool, remove the buret from its holder and bring it to eye level.

THOUGHTLESSNESS. Most lab accidents are caused by impulsive actions performed with little or no forethought. Think before acting, check with an instructor if you are not sure of a procedure, and always plan ahead before coming into the laboratory. Being prepared will help prevent accidents and minimize rushed procedures.

Toxicity of Chemicals

Almost all chemicals are toxic to some degree, and they should be used with proper precautions and only after looking up their properties in an appropriate handbook or Safety Data Sheet (SDS). Read the label on the container to get an idea of the chemical's dangerous properties and of any safety procedures or antidotes for accidental contact or ingestion. For example, several chemicals that have been found to induce tumors in animals are on the list of the Carcinogen Assessment Group (U.S. EPA) and in the monograph entitled "Chemical Carcinogens" (C. Searle, ed., Amer. Chem. Soc.). Among these are arsenic compounds, asbestos, benzene, benzo[a]pyrene, cadmium compounds, carbon tetrachloride, chloroform, chromium(VI) compounds, DDT, formaldehyde, hydrazine, nickel compounds, saccharin, thioacetamide, thiourea, and vinyl chloride.

A typical example of risk assessment for the chemist is the use of arsenic(III) oxide, As_2O_3, as a primary standard in analysis. The hazard statement on most bottles reads: "Danger! Contains inorganic arsenic. Cancer hazard. Poison: May be fatal if swallowed or inhaled. Use only with adequate ventilation." This warning does not imply that a trained analyst cannot use arsenic(III) oxide in the lab. It means that the chemist must be careful in handling this material and must avoid certain operations that might increase the danger of ingestion or inhalation of it. For example, it should not be dried in a conventional oven. Fortunately, most lab uses do not require it to be oven-dried, since it is not hygroscopic. One can safely handle it as long as it isn't swallowed or inhaled. The use of gloves is helpful, and the fume hood should be used when dissolving it. Once it is dissolved, it may be titrated in the open lab. However, when the work is finished, it must be disposed of properly according to the recommendations of the instructor or a handbook, if available.

Disposal of Chemicals and Cleaning Spills

The following rules should be obeyed when disposing of chemicals or cleaning up chemical spills:

1. Never throw solid chemicals into the sink. Use a designated waste jar trash container for solids.

2. Dispose of small amounts of acid or base by diluting them into a larger beaker of water and then pouring this solution down the sink with a large volume of water. It is necessary to neutralize more concentrated acids with dilute sodium bicarbonate before pouring into the sink.

3. Diluted solutions of inorganic salts may be flushed down the drain as long as they do not contain the toxic metals As, Ba, Cd, Cr, Pb, Hg, Se, and Ag (unless in small amounts).

4. Organic liquids and large amounts of acid should be poured into suitably designated containers. Do not mix acids with strong bases. Pour them into separate containers.

5. Spills of chemicals should be cleaned by first pouring large amounts of water on them (as long as they do not react with water) to dilute them. Then neutralize, if necessary, with dilute sodium bicarbonate. After that, clean up the neutral solution and rinse the area with clean water.

6. In general, keep benches clean at all times. At the end of the day, all work areas and equipment should be cleaned and properly stored.

7. Always refer to detailed references on disposal, recycling, and detoxification of laboratory chemicals before disposing of any chemical waste. Most lab safety texts and references contain or refer to this information, and MSDS sheets contain toxic properties and handling procedures.

References

1. "Quantitative Analytical Chemistry", J. S. Fritz and G. H. Schenk, Allyn and Bacon, 1987.

2. "Fundamentals of Analytical Chemistry", D. A. Skoog, D. M. West, and F. J. Holler, Saunders College Publishing, 3rd edition, 1988.

3. "The Disposal of Chemical Laboratory Wastes", E. Glod, Hazardous Waste Coordinator, Ohio EPA, 1981 (draft).

4. "Prudent Practices for Handling Hazardous Chemicals in Laboratories", National Academy Press, Washington, D.C., 1980.

FOR MORE INFORMATION ON PROPER SAFETY PROCEDURES PLEASE CONSULT THE MU CHEMISTRY DEPARTMENT - CHEMICAL HYGIENE PLAN
(Established: July 1, 2016)
The Chemical Hygiene Plan is available on the chemistry webpage:
http://www.millersville.edu/chemistry/
(pdf file under Resources)

THE STUDENT CHAPTER OF THE AMERICAN CHEMICAL SOCIETY

The Student Chapter of the American Chemical Society is an active group of students interested in chemistry. The chapter has been recognized several times as being outstanding by the American Chemical Society. The activities of the chapter during the past three years have included the following:

A. Sponsoring seminar speakers.

B. Sponsoring films on chemical topics.

C. Arranging trips to Washington, D.C., Philadelphia, PA, and Baltimore, MD.

D. Arranging trips to area industries and laboratories, including Armstrong World Industries, Air Products Corporation, and Lancaster Laboratories, among others.

E. Arranging trips to local, regional, and national meetings of the American Chemical Society.

F. Assembling molecular model kits for sale to students enrolled in chemistry courses.

G. Guiding prospective students through the department, including groups of high school students.

H. Acting as Peer Advisors to incoming freshmen chemistry majors.

I. Sponsoring student-faculty parties, notably one at Halloween.

Although the University requires the chapter to have a faculty advisor, faculty involvement in the planning and coordination of these activities is minimal. Interested students are invited to attend a meeting of the chapter. They can attend, but not vote, without becoming members. Some of the benefits of becoming a member are the receipt of a sampling of professional journals from the American Chemical Society, reduced attendance fees at ACS meetings, and access to the benefits of the ACS (including job placement). Membership costs are minimal since the Student Chapter as a group receives financial support from the ACS.

CHEMISTRY TUTORS/TUTORING

For students who need tutoring.

Tutors are available for most of the chemistry courses, particularly those at the freshman and sophomore level. Group tutoring sessions for CHEM 111, 112 are available weekly. The specific times and locations are announced early in the semester and are posted throughout Roddy. Individual tutoring is also available.

If you do sign up for tutoring, it is your responsibility to keep your appointments with the tutor and to do the assigned work. Tutoring tends to be most productive when done on a regular basis and with preparation. Coming just before an exam or for last minute help with lab reports is not particularly beneficial for either party involved.

For students who wish to be tutors:

Tutoring presents an opportunity for chemistry majors to improve their own understanding of chemistry while helping other students to learn.

There is always a need for chemistry tutors, especially in Introductory, General, and Organic Chemistry, but tutors have been requested for other chemistry courses as well. Tutoring is particularly valuable for students preparing to be teachers or for those contemplating teaching.

To be eligible to become a tutor you should have received an A or B in the course or be recommended by a chemistry professor. If interested, see the chemistry faculty tutor coordinator to fill out the necessary forms and for further instructions on record keeping and tutor assignments.

Governance & Policies

Student Policy

ACADEMIC HONESTY POLICY

Approved: April 1, 2008, Faculty Senate

Deans' Council

Students of the University are expected to be honest and forthright in their academic endeavors. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an examination, to allow another person to commit, or assist another in committing an act of academic dishonesty, corrupts the essential process by which knowledge is advanced.

Actions that Violate the Academic Honesty Policy- The below lists are for illustration only. They should not be construed as restrictive or as an exhaustive enumeration of the various forms of conduct that constitute violations of the academic honesty policy.

Plagiarism

Plagiarism is the inclusion of someone else's words, ideas, or data as one's own work. When an individual submits work that includes the words, ideas, or data of others, the source of that information must be acknowledged through complete, accurate, and specific references. If verbatim statements are included, it must be through quotation marks or other accepted citation practices. By placing his/her name on a scholarly product, the student certifies the originality of all work not otherwise identified by appropriate acknowledgments. Plagiarism would thus include representing as one's own any academic exercise (e.g. written work, computer program, sculpture, etc.) prepared totally or in part by another. An individual will avoid being charged with plagiarism if there is an acknowledgment of indebtedness whenever one:

1. quotes another person's actual words;
2. uses another person's ideas, opinions, or theories, even if they are completely paraphrased in one's own words;
3. borrows facts, statistics, or other illustrative materials, unless the information is common knowledge.

These guidelines should be followed for all source types, including books, newspapers, pamphlets, journal articles, websites, and other online resources. The above list is for illustration only. It should not be construed as restrictive or as an exhaustive enumeration of the various forms of plagiarism that constitute violations of the academic honesty policy.

Fabrication

Fabrication is the falsification of research or other findings. The below list is for illustration only. It should not be construed as restrictive or as an exhaustive enumeration of the various forms of fabrication that constitute violations of the academic honesty policy.

1. Citation of information not taken from the source indicated.
2. Listing in a bibliography sources not actually consulted.
3. Inventing data or other information for research or other academic projects.

Cheating

Cheating is the act or attempted act of deception by which an individual tries to misrepresent that he/she has mastered subject matter in an academic project or the attempt to gain an advantage by the use of illegal or illegitimate means. The below list is for illustration only. It should not be construed as restrictive or as an exhaustive enumeration of the various forms of cheating that constitute violations of the academic honesty policy.

1. Copying from another student's test paper.
2. Allowing another student to copy from one's test paper.
3. Using the course textbook, or other material such as a notebook, brought to class meetings but unauthorized for use during a test.
4. Collaborating during a test with another person by receiving or providing information without the permission of the instructor.
5. Using or possessing specifically prepared, unauthorized materials during a test (e.g., notes, formula lists, formulas programmed into calculators, notes written on the student's clothing or person) that are unauthorized.

Academic Misconduct

Academic misconduct is the violation of University policies by tampering with grades or participating in the distribution of any part of a test before its administration. The below list is for illustration only. It should not be construed as restrictive or as an exhaustive enumeration of the various forms of academic misconduct that constitute violations of the academic honesty policy.

1. Stealing, buying, or otherwise obtaining all or part of an unadministered test.
2. Selling or giving away all or part of an unadministered test, including answers to an unadministered test.
3. Bribing, or attempting to bribe, any other person to obtain an unadministered test or any information about the test.
4. Buying, or otherwise acquiring, another's coursework and submitting it as one's own work, whether altered or not.
5. Entering a building, office, or computer for the purpose of changing a grade in a grade book, on a test, or on other work for which a grade is given.
6. Changing, altering, or being an accessory to changing and/or altering a grade in a grade book, on a test, on a "Change of Grade" form, or other official academic University record which relates to grades.
7. Entering a building, office, or computer for the purpose of obtaining an unadministered test.
8. Continuing to work on an examination or project after the specified allotted time has elapsed.
9. Taking a test or course for someone else or permitting someone else to take a test or course in one's place.
10. Giving or taking unauthorized aid in a take home exam, paper, or other assignment.
11. Submitting work for a class that was already submitted for another class, when unauthorized, or allowing another student to submit or copy from your previously submitted class work.

Actions which may be taken for violations of the Academic Honesty Policy

When a faculty member suspects that a violation of the academic honesty policy has occurred, he/she will meet with the student to:

a) discuss the alleged act;
b) hear any defense the student may have;
c) discuss any proposed academic sanctions;
d) inform the student of his/her right to appeal faculty imposed sanctions to the department chair and/or dean of the school

Academic sanctions that may be imposed by the faculty member include:

a) a verbal reprimand;
b) a written reprimand;
c) requiring the student to redo/resubmit the assignment, test, or project;
d) lowering the grade for the assignment, test, or project

The above list is for illustration only. It should not be construed as restrictive or as an exhaustive enumeration of the various sanctions that may be imposed by instructors for violations of the academic honesty policy.

Academic sanctions that require a formal charge be filed with the Associate Provost for Academic Administration include:

a) any sanction in excess of lowering the grade for an assignment, test ,or project;
b) failing the student for the course;
c) recommending temporary or permanent suspension from the academic major or University.

Regardless of the level of academic sanction imposed or requested above, faculty members are encouraged to submit a report for each violation of the Academic Honesty Policy to the Associate Provost for Academic Administration. If more than one (1) such report is filed for a student, even in the case of sanctions imposed only by the faculty member, then the Associate Provost for Academic Administration will meet with the student to discuss these occurrences and possibly impose additional academic sanctions.

Confidentiality

In accordance with the provisions of the Family Educational Rights and Privacy Act of 1974, any information relating to an alleged violation of the University's Student Code of Conduct or to the outcome of a judicial hearing must be treated as strictly confidential by members of the faculty.

MU CHEMISTRY DEPARTMENT POLICY ON THE USE OF INTERNET SOURCES

The Millersville University Academic Honesty and Dishonesty policy applies to all sources, including web pages. It states that you may be guilty of plagiarism if you do any of the following without acknowledging the source.

1. Quote another person's actual words.
2. Use another person's ideas, opinions, or theories, even if they are completely paraphrased in [your] own words.
3. Borrow facts, statistics, or other illustrative materials, unless the information is common knowledge.

You should make every effort to identify reliable sources. By using an internet source for scientific or class work, you assume full responsibility for its accuracy.

Some original thinking and/or a synthesis of ideas from multiple sources is expected in all research assignments.

A collection of copied material, even if the sources are cited, does not constitute original work. In particular, it is NOT permissible to copy and paste the following.

1. charts
2. diagrams
3. formulas
4. structures
5. text

You are expected to adapt and recreate these, and acknowledge the source. Exceptions in the case of photographs, spectra, or complex structures that cannot reasonably be redrawn will be considered only if they are essential to a project and their use must be approved by the instructor.

A citation to a web page must follow the format specified by the instructor.

BACKGROUNDS AND CURRENT RESPONSIBILITIES OF THE CHEMISTRY FACULTY

DR. DANIEL R. ALBERT joined the Chemistry Department in August 2016. He received his B.A. (2007) from Ohio Wesleyan University, his M.S. (2008) the University of Wisconsin-Madison, and his Ph.D. (2013) in Physical Chemistry from Cornell University. As a graduate student, Dr. Albert's research involved using molecular beam scattering to characterize chemical reactions. Much of his graduate work involved developing high-intensity vacuum ultraviolet laser sources for molecule detection via "soft" single-photon ionization. Before coming to Millersville, Dr. Albert was an Assistant Professor of Chemistry at the University of Wisconsin-Stevens Point from 2013 – 2016. His major teaching responsibilities are Introductory Chemistry and Physical Chemistry. Dr. Albert's current research interests involve investigating chemical reactions taking place on aerosol particles and how molecules on the surfaces of these particles influence their reactivity. Dr. Albert is also interested in developing low-cost instruments for teaching about and using instrumentation in classrooms.

DR. KATHRYN R. ALLEN joined the Chemistry Department in August 2014. She received her B. S. (2004) from Juniata College and her Ph.D. (2010) from Columbia University. Prior to coming to Millersville University, she did her post-doctoral studies at the University of Southern California. Dr. Allen's research involves the development and synthesis of unique polymer structures for materials applications. Dr. Allen is interested in the use of these polymers for implementation in solar cells. She teaches Polymer Chemistry, the Short Course in Organic Chemistry, and Introductory Chemistry courses.

DR. STEVEN M. BONSER joined the Chemistry Department in July of 2007. He received his B.S. (1974) in Chemistry from Kutztown University, his M.S. (1977) in Chemistry from Bucknell University, and his Ph.D. (1983) in Organic Chemistry from the University of Minnesota. While at Bucknell, he was the recipient of a summer Research Fellowship at the University of Leiden, The Netherlands. After obtaining his Ph.D., Dr. Bonser joined the Research and Development Laboratories of the Eastman Kodak Company in Rochester, NY, where he designed, synthesized, and developed a wide range of complex heterocyclic imaging chemicals. During his time with Kodak, Dr. Bonser was also a Visiting Scholar in Chemistry at Harvard University (1991-1993) where he worked in the Laboratory of Professor George W. Whitesides. Before coming to Millersville, Dr. Bonser taught organic chemistry at Bloomsburg University. He is teaching Introductory Organic Chemistry and Advanced Organic Chemistry. Dr. Bonser's research interests are in the areas of synthetic organic and physical organic chemistry, with a particular emphasis on small ring chemistry, heterocyclic chemistry, polyaromatic chemistry, and process development chemistry.

DR. MICHAEL S. ELIOFF joined the department in August 2012. He received his BS (1991) in mathematics and his MS (1995) in chemistry from the University of Texas. After teaching high school chemistry and calculus, he entered the PhD program at Boston University to work with Amy Mullin on quantum state-resolved energy transfer mechanisms in vibrationally excited molecules. He received his PhD (2001) in chemistry from BU and went on to do a post-doctoral fellowship (2001-2004) at Sandia National Laboratories in Livermore, CA, during which time he did a visiting fellowship at Vrije Universeit in Amsterdam (Fall 2003) with Steven Stolte. He has held two tenure-track assistant professorships prior to arriving at Millersville. Dr. Elioff's research interests are in the areas of atmospheric photophysics, cold molecule formation, fluorescence, propellants, and combustion. He is currently interested the problems associated with calculating solid-phase heats of formation for various propellants and explosives, as well as in studying the dynamics and kinetics of fluorescence and fluorescence quenching of biologically important fluorophores. His teaching responsibilities include Introductory Chemistry and Physical Chemistry.

DR. STEVEN M. KENNEDY joined the Chemistry Department in July of 2012. He received his B.S. (2004) in Chemistry from Lewis-Clark State College and his Ph.D. (2010) in Organic Chemistry from the University of California, Irvine. While at UC Irvine, he was the recipient of the 2007 – 2008 Eli Lilly Research Fellowship for his studies toward the synthesis of the anticancer polyketide, spirastrellolide A. After obtaining his Ph.D., Dr. Kennedy contributed to the development of environmentally responsible palladium catalyzed reaction methods as a Postdoctoral Fellow at the University of Pennsylvania (2010 – 2012) where he worked in the laboratory of Professor Gary A. Molander. Dr. Kennedy's research interests are in the areas of synthetic organic, organometallic catalysis, and reaction methods development. The central themes of his research include: design, synthesis and biological evaluation of truncated natural product analogues; utilization of high-throughput screening techniques to expedite new reaction discovery; development of synthetic routes and synthetic methods that are environmentally conscientious.

DR. JEREMIAH K.N. MBINDYO joined the Chemistry Department in August of 2002. He received his B.Ed. [Sc.] (1987) from Kenyatta University-Nairobi, his M.Sc. (1993) from the University of Nairobi-Kenya and his Ph.D. (1999) from the University of Connecticut. Before coming to Millersville, Dr. Mbindyo did post doctoral research at Pennsylvania State University in the area of nanotechnology. His research interests are in the areas of nanotechnology, electroanalytical and environmental chemistry. He is developing nanoscale sensors for environmental monitoring and studying electron transfer reactions in the solid state. Since coming to Millersville, Dr. Mbindyo has taught Environmental Chemistry and Introductory Chemistry.

DR. AIMEE L. MILLER joined the Chemistry Department in August of 2003. She received her B.A. (1992) from Eastern Mennonite University and her Ph.D. (2000) from the University of Virginia. Prior to coming to Millersville, she did post-doctoral studies of nuclear transport at Washington University in St. Louis and Vanderbilt University. Dr. Miller's research utilizes the power of yeast genetics to unravel biochemical functions at a cellular level. Her interests include studies of proteins involved in inositide pathways as well as characterization of novel genes in *Saccharomyces cerevisiae* (baker's yeast). She teaches Introductory Chemistry and Biochemistry. She is currently serving as the department chair.

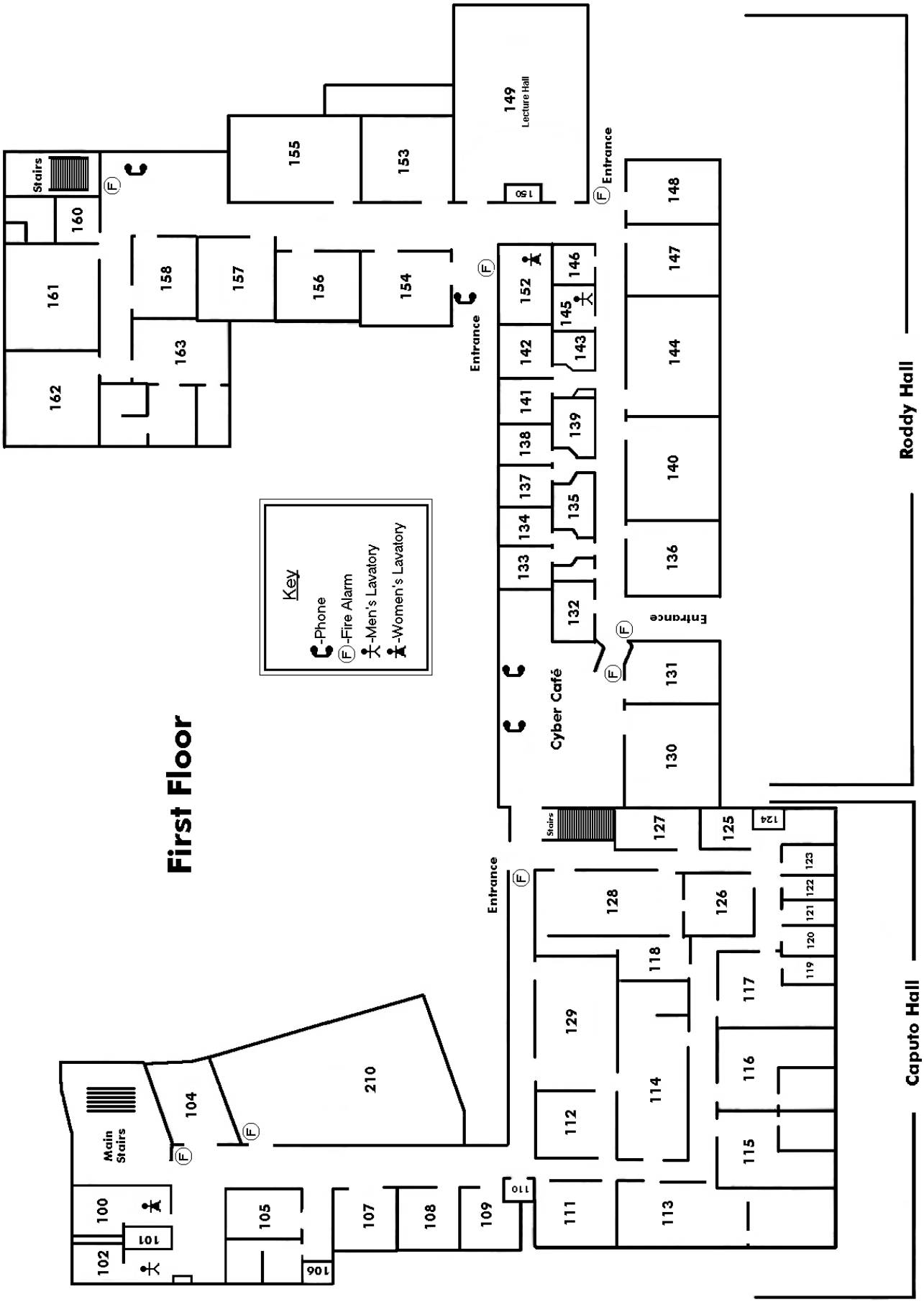
DR. MELISSA A. MULLEN DAVIS joined the Chemistry Department in August 2018. She received her B.A. (2005) in Chemistry and Spanish from Colby College and her Ph.D. (2011) in Chemistry from The Pennsylvania State University. Her graduate work focused on nucleic acid biochemistry, studying interactions between nucleic acids with metals and small molecules as well as how those interactions affect nucleic acid folding. Prior to coming to Millersville University, Dr. Mullen Davis completed a Postdoctoral Research Fellowship at the Cleveland Clinic Lerner Research Institute (2011-2014) where she studied mechanisms of eukaryotic transcription and was a Visiting Assistant Professor of Biochemistry and Molecular Biology at The College of Wooster (2014-2018). Dr. Mullen Davis' research focuses on gene regulation by transcription factors in prokaryotes and by long non-coding RNAs in model plant systems. Her current research investigates how these organisms respond to abiotic stresses including oxidative stress and low nutrient stress. Dr. Mullen Davis teaches Biochemistry courses and Introductory Chemistry courses.

DR. R. EDWARD RAJASEELAN joined the Chemistry Department in August of 1990, following a year of teaching and research at St. Olaf College. He received his B.S. (1981) from the University of Peradeniya-Sri Lanka and his Ph.D. (1989) from the University of Arizona. Dr. Rajaseelan's research interests are in the areas of coordination and organometallic chemistry. His current research involves synthesis and characterization of N-heterocyclic Carbene Complexes of Rhodium and Iridium and studying their catalytic properties in various transfer hydrogenation reactions. He teaches Introductory Chemistry courses for science majors and non-science majors, Inorganic chemistry, Advanced Lab and Advanced Inorganic Chemistry.

.

DR. LYMAN H. RICKARD joined the Chemistry Department in August 1989. He received his B.S. (1973) and M.S. (1975) from the University of Southern Mississippi and his Ph.D. (1985) from the Florida Institute of Technology. Before coming to Millersville, Dr. Rickard taught chemistry at High Point College in North Carolina for fourteen years. Dr. Rickard's research interests are in chemical education and the electron transfer reactions of biological molecules. He has been active in the ACS serving in various offices and as councilor of the Central North Carolina Section. His major teaching responsibilities are in Introductory Chemistry. He served as chair of the department from 1999-2002.

DR. MARIA V. SCHIZA joined the Chemistry Department in August of 2005. She received her B.S. (1995) in Chemistry from Roosevelt University and her Ph.D. (2001) in Analytical Chemistry from the University of South Carolina. Following graduation she did postdoctoral research at the University of South Carolina in the area of thin film fabrication and optical sensing. Dr. Schiza also worked for Science and Technology Corporation in the area of bacterial spore detection. Before coming to Millersville, she taught chemistry for a year at Armstrong Atlantic State University. Dr. Schiza's research interests include the development and characterization of new materials, particularly nanomaterials, for potential applications to sensing and photocatalysis of organic contaminants such as organochlorides and organophosphides. Dr. Schiza is interested in the synthesis of inorganic nanoparticles using the sol-gel process and the study of their chemical and physical properties by spectroscopic and microscopic techniques.



Back to Table of Contents

Caputo Offices

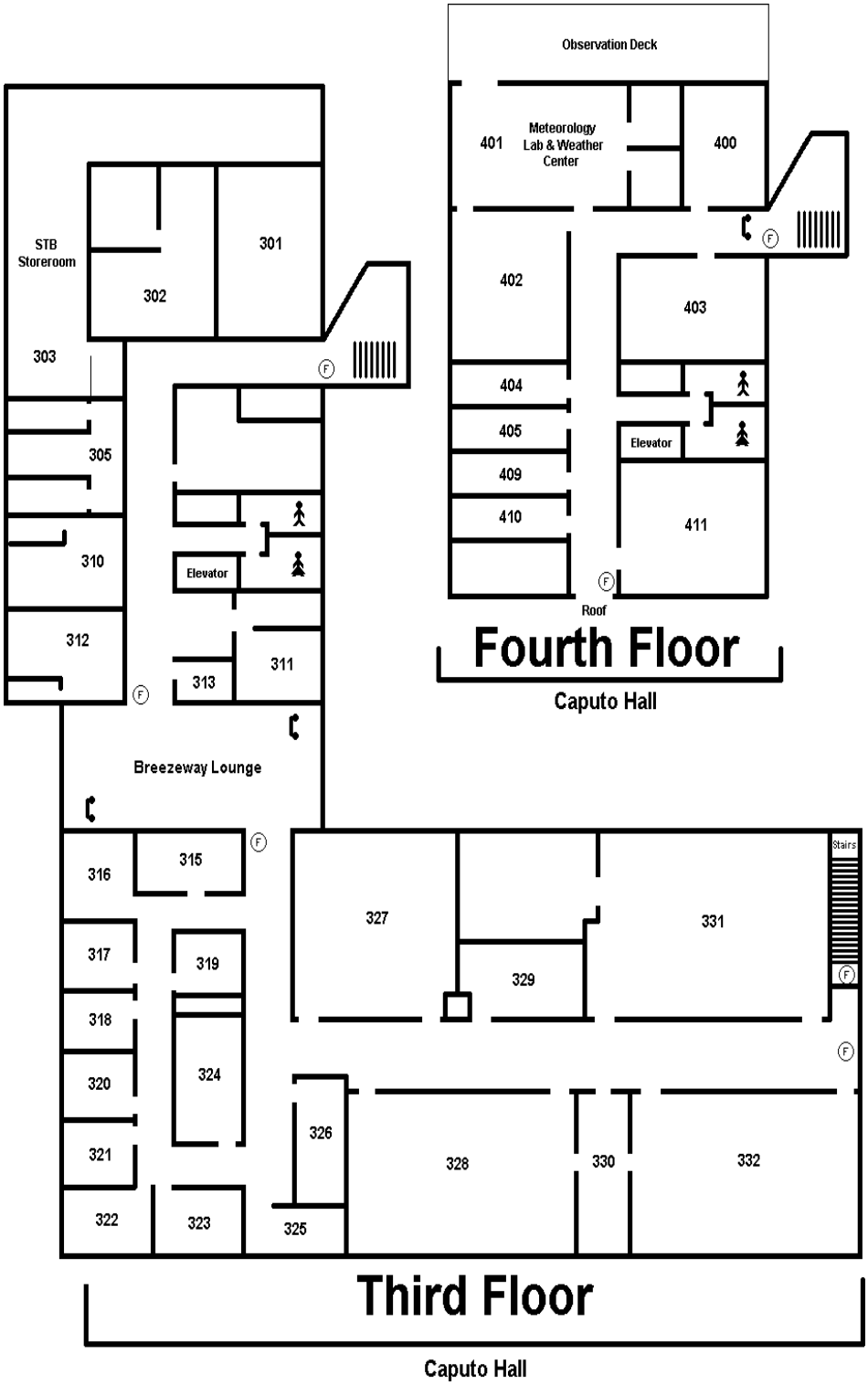
213 Dr. Edward Rajaseelan
214 Dr. Daniel Albert
215 Dr. Lyman Rickard
218 Dr. Melissa Mullen Davis
219 Dr. Maria Schiza

Student Study Room

Roddy 229 Chemistry Student Lounge

234 **Administrative Assistant:**
Ms. Emily Drennen

Back to Table of Contents



Lab Technician
330 B Mr. Stephen Peurifoy

Caputo Offices
317 Dr. Kathryn Allen
318 Dr. Steven Kennedy
320 Dr. Michael Elioff
321 Dr. Jeremiah Mbindyo
323 Dr. Steven Bonser
325 Dr. Aimee Miller

Back to Table of Contents