

**Advising Manual**  
**for**  
**Chemistry Programs**

**in the**

**Department of Chemistry and Physics**

**Mansfield University**

Revised Fall 2010

## PREFACE

This Advising Manual was prepared for those with an interest in chemistry at Mansfield University. It is intended as a guide to the programs and specific course requirements for the degree programs in chemistry in the Department of Chemistry and Physics. At the time of revision, all information contained in this manual was currently valid. Due to the dynamic nature of academic institutions, changes may have since been made to programs or requirements. For the most up-to-date information, consult a current university catalog (contents of the current catalog are available online at "catalog.mansfield.edu") or the department web page at "mansfield.edu/chemistry-physics". For more information about Mansfield University, contact the Admissions Office (South Hall, Mansfield University, Mansfield, PA, 16933; by phone at (800) 577-6826 or (570) 662-4243) or see the web page (admissions.mansfield.edu). For more information about the Department of Chemistry and Physics, contact any of us at Grant Science Center, Mansfield University; phone and e-mail information are on the departmental web page.

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## GREETINGS

Greetings from the Department of Chemistry and Physics at Mansfield University! Since you are reading this booklet, you will possibly have some contact with us in the future. We sincerely hope that whatever contact we may have will be educational and beneficial to you. We are a small but broadly-based, challenging, and caring department interested in your educational needs and aspirations. Chemistry surrounds us in all aspects of our lives and careers. We would like to help you see its relevance to your career plans. In whatever capacity, as a major, minor, or as part of your required curriculum, we will try to help you fully realize your goals. This Advising Manual describes various aspects of the department and the institution and some programs and unique opportunities available at Mansfield University. Please contact us if you have questions about any part of the chemistry program at Mansfield University. We wish you well in your academic endeavors.

## CHEMISTRY AND CAREER OPTIONS

Chemistry is the branch of science that relates phenomena in the world around us with the properties and behavior of the atoms and molecules from which the world is made. The study of chemistry makes students aware of those relationships and prepares them for a variety of careers in business, industry, academia, and government. Opportunities within these areas range from laboratory and technical work, to sales, marketing, and customer service, to management and supervisory positions. A graduate with a chemistry major or minor has acquired many skills that employers seek, especially in the areas of problem solving and decision making.

Our programs prepare you for advanced studies in a range of professions, including medicine, dentistry, optometry, and various aspects of the law, while our more recently developed tracks in forensic science and nanotechnology focus on these rapidly-growing disciplines. Many of our Bachelor of Science (B.S.) graduates continue their chemistry studies in graduate school. Another option for B.S. chemistry majors is to pursue a career in industry immediately upon graduation. The food, pharmaceutical, petroleum, and chemical industries offer positions involving both laboratory and non-laboratory work. In addition, Mansfield University offers a teacher certification program in chemistry, resulting in the Bachelor of Science in Education (B.S.E.). These graduates find themselves in great demand due to the national shortage of qualified high school science teachers.

In addition to the programs leading to the B.S. and B.S.E., the department provides service courses for several biology, physics, geography, and health science programs and offers minors in chemistry and in forensic science. If we can give you assistance by providing additional information, please contact us.

## THE DEPARTMENT OF CHEMISTRY AND PHYSICS

The Department of Chemistry and Physics at Mansfield University is housed in Grant Science Center. Expanded in 1971, Grant Science Center is shared with the Biology Department and contains extensive modern laboratory facilities, including lab-lecture rooms, separate instrumental laboratories, a planetarium, dark room, and stockroom.

In addition to the usual laboratory equipment and glassware, the department has available a large assortment of instrumentation available for student use, including:

- atomic absorption spectrometer
- gas chromatograph
- gas chromatograph/mass spectrometer
- high-performance liquid chromatograph
- Fourier-transform infrared spectrometers
- UV-visible spectrophotometers
- spectrofluorometer
- nuclear magnetic resonance spectrometer

The facilities and equipment are used by students throughout their studies at Mansfield in a variety of supervised laboratory experiences, both in course work and in independent research. The entire chemistry curriculum is designed to give students a broadly-based background in the theory and practice of chemistry and is structured to meet the standards of the American Chemical Society and the needs of a small department.

Close student-faculty interaction assures students of access to and the attention of their faculty. Students and faculty often develop relationships that extend beyond the classroom, by interaction in social activities such as picnics, field trips, and athletics, to private conversations about research and career plans. During a visit to Grant Science Center, you may see students and faculty engaged in discussions of all sorts. Students often have a cup of coffee in the department office to pass a few minutes between classes, or drop in at their professor's office to chat. This informal, open spirit provides an optimal learning environment for both students and faculty.

## OPPORTUNITIES AND ACTIVITIES

A quality undergraduate degree is more than an accumulation of courses in a major. Courses must be taught by faculty who care about each student's needs and talents. At Mansfield, courses within and without the major are taught by such faculty. Courses in the major concentration must provide a solid basis for a student's future career. A list of courses required for the various chemistry degrees is presented in a later section. Additional courses required of all Mansfield students ensure a well-rounded liberal arts education.

However, a quality degree program also provides students with opportunities outside the classroom. In the Department of Chemistry and Physics, several such opportunities and activities exist for students to utilize their undergraduate experiences in non-traditional ways. All of these enhance the student's educational experience. Students should consider participating in such activities during their undergraduate experience.

*Employment/Cooperative Education.* As a chemistry major, you will have skills even before you graduate that employers are seeking. There are numerous opportunities for summer employment in academic or industrial laboratories. In academic labs, this experience involves students in current state-of-the-art research. In industrial labs, students may be involved with different experimental techniques, often new to them. Such experiences broaden students'

knowledge and increase their confidence. Announcements for these employment opportunities arrive regularly at Mansfield.

Several local industries have made arrangements with Mansfield students to continue their employment into the academic year. These students receive course credit for their work experience through a cooperative education agreement, enabling them to earn and learn at the same time.

*Research.* In addition to the experience in practical and routine laboratory practices gained by employment, there are opportunities for students to participate in faculty research projects. In these projects, students are primary researchers, working first-hand on a project and its analysis. Relationships between students and faculty become more collegial as they work toward the common goal of understanding a research problem. Engaging students actively in performing research gives them a valuable glimpse of basic research in action.

*Chemistry Club.* The Chemistry Club is a non-academic, social organization to which most chemistry majors belong. The Chemistry Club offers opportunities for students and faculty to meet in an informal setting. Activities include picnics, pizza parties, field trips, hosting speakers and school tours, and performing demonstrations for National Chemistry Week. Chemistry Club members are eligible to become student affiliate members of the American Chemical Society (ACS), the professional society for chemists in the United States. As an ACS affiliate, the student is provided with the advantages of a professional society, including a student newsletter, career opportunities, employment aids, and current scientific information.

*ACS Certification.* Our Chemistry program has been approved by the American Chemical Society, which allows us to grant ACS certification to graduates meeting specific criteria. An ACS-certified degree lets prospective employers know that a graduate has met educational standards set by one of the world's largest professional organizations.

## GENERAL PROGRAM REQUIREMENTS

B.S. in Chemistry

The Department of Chemistry and Physics offers a major program (120 credits total) leading to the Bachelor of Science (B.S.) in Chemistry with four different concentrations: chemistry, forensic science, biochemistry, and nanotechnology.

The four concentrations share a common core of 49 credits of chemistry, physics, and math courses (course descriptions may be found at the end of this manual):

CHM 1111	General Chemistry I	4	MA 2231	Calculus I	4
CHM 1112	General Chemistry II	4	MA 2232	Calculus II	4
CHM 3301	Organic Chemistry I	4	MA xxxx	Math Elective (1125	
CHM 3302	Organic Chemistry II	4		or higher)	3
CHM 3311	Quantitative Analysis	4	PHY 2210	General Physics I	4
CHM 3321	Physical Chemistry I	4	PHY 2211	General Physics II	4
CHM 3332	Instrumental Analysis	4			
CHM 4410	Seminar (twice)	1			

The four concentrations differ in their requirements for upper-level courses:

Chemistry Concentration: (21 credits)

CHM 3322	Physical Chemistry II	4
CHM 4420	Qualitative Organic Chemistry	3
CHM 4431	Advanced Inorganic Chemistry	4
CHM xxxx	Chemistry Electives (3341, 4421, 4432)	6
MA 2233	Calculus III	4

Forensic Science Concentration: (27 credits)

SCI 1104	Introduction to Forensic Science	3
CHM 3264	Chemical Methods in Forensic Science	3
CHM 4420	Qualitative Organic Chemistry	3
PHY 3264	Physical Methods in Forensic Science	3
MA 2233	Calculus III	4

One of the following:

CJA 3262	Investigation and Interrogation	3
CJA 3336	Criminalistics	3
CJA 3355	Evidence and Criminal Procedure	3

Two of the following:

CHM 3322	Physical Chemistry II	4
CHM 3341	Biochemistry	4
CHM 4431	Advanced Inorganic Chemistry	4
BI 3370	Cell Biology	4

Biochemistry Concentration: (21 credits)

CHM 3341	Biochemistry	4
BI 3370	Cell Biology	4
BI xxxx	Biology Electives (3310, 3371, 3372, 3374, 3375)	6

One of the following:

CHM 3322	Physical Chemistry II	4
CHM 4431	Advanced Inorganic Chemistry	4

One of the following:

CHM 4420	Qualitative Organic Chemistry	3
CHM 4421	Advanced Organic Chemistry	3

Nanotechnology Concentration: (21-22 credits)

SCI 3270	Nanotechnology Laboratory Experience	18
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One of the following:

CHM 3322	Physical Chemistry II	4
CHM 4420	Qualitative Organic Chemistry	3
CHM 4421	Advanced Organic Chemistry	3
CHM 4431	Advanced Inorganic Chemistry	4

B.S.E. in Secondary Education/Chemistry

The Department also offers a program (127-128 credits total) leading to the Bachelor of Science in Education and certification as a qualified chemistry teacher in secondary schools. Required courses for the major include (103-104 credits):

BI 3370	Cell Biology	4
CHM 1111	General Chemistry I	4
CHM 1112	General Chemistry II	4
CHM 3301	Organic Chemistry I	4
CHM 3302	Organic Chemistry II	4
CHM 3311	Quantitative Analysis	4
CHM 3321	Physical Chemistry I	4
CHM 3332	Instrumental Analysis	4

CHM 4410	Seminar (twice)	1
CHM xxxx	Chemistry Electives (3322, 3341, 3352, 4420, 4421, 4431, 4432)	6
ED 1105	Education First-Year Seminar	1
ED 1110	Foundations of Education	2
ED 2205	Educational Psychology	3
ED 3310	Content Area Reading and Writing	3
ED 3313	Teaching Secondary Science	3
ED 3320	Observation and Participation	3
ED 4400	Student Teaching	12
ED 4400L	Senior Lab: Becoming a Professional	0
ENG xxxx	Literature	3
MA 2231	Calculus I	4
PSY 1101	Introduction to General Psychology	3
PSY 3321	Adolescent Psychology	3
SPE 1001	Foundations in Special Education	3
SPE 2276	Instructional Strategies for English Language Learners	3
SPE 3291	High Incidence Disabilities	3
SPE 3352	Assessment and Evidence Based Behavior Support for Inclusion	3
One of the following:		
MA 1125	Introductory Statistics I	3
MA 2232	Calculus II	4
One of the following:		
PHY 1191	Physics I	4
PHY 2210	General Physics I	4
One of the following:		
PHY 1192	Physics II	4
PHY 2211	General Physics II	4

### General Education

Besides the course requirements for the major programs, all four-year students at Mansfield University must complete a General Education program. The General Education program has a core of 16 credits:

UNV 1100	First-Year Experience Seminar	1 (except BSE majors)
COM 1101	Oral Communication	3
ENG 1112	Composition I	3
ENG 3313	Composition II	3



One of the following Fine Arts courses:

ARH 1101	Introduction to Art	3
MU 1101	Introduction to Music	3
THT 1110	Introduction to Theater	3

Three credits of coursework carrying Wellness credit (see current catalog).

The General Education program also includes coursework (39 credits) in other disciplinary areas. Requirements for three credits of Mathematics, six credits of Natural Science, and nine credits of unspecified General Education Electives are already met by the major requirements described above. Additionally, students in Chemistry programs must earn six credits each in the areas of Humanities and of Languages and Literature, and nine credits in the area of Social Sciences. *Students should consult the University catalog or registration master schedules to identify specific courses that meet these requirements.*

Further General Education requirements for courses designated as addressing Information Literacy, or approved for Writing Across the Curriculum, may already met by General Education core courses and by the major requirements described above. Chemistry majors must take three courses designated as addressing Global Awareness, with at least one at the upper level (3000 or higher). *Students should consult registration master schedules to identify specific courses that meet these requirements.*

There is a University graduation requirement that at least 40% of your coursework (48 semester hours) be at the upper level (3000 or higher). Most of this requirement is met by the General Education and major requirements described above, but some Chemistry students may need to take an upper-level nonmajor course beyond those specified among their General Education courses.

### SPECIFIC FOUR-YEAR PLANS

The following pages list recommended four-year sequences of coursework for the programs described above. Because some upper-level courses are not offered every year, course sequences will vary somewhat depending whether a student begins in an odd or an even year. Descriptions for each program are followed by a checklist which students should complete as they meet the various requirements.

B.S. Chemistry, Chemistry Concentration  
(odd-year start)

Fall 2011	CHM 1111	4	Spring 2012	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2012	CHM 3301	4	Spring 2013	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2013	CHM 3321	4	Spring 2014	CHM 4410	1	
	CHM 4420	3		CHM 4432 or Free Elective	3	
	PHY 2211	4		CHM 4431	4	
	MA 2233	4		ENG 3313	3	
				Gen. Ed.	3	
		15			14	29
Fall 2014	CHM 4421 or Free Elective	3	Spring 2015	CHM 3322	4	
	CHM 4490 or Free Elective	3		CHM 3341 or Free Elective	3	
	Gen. Ed.	6		CHM 4410	1	
	Free Elective	3		Gen. Ed.	3	
				Free Electives	4	
		15			15	30
				Total		120

B.S. Chemistry, Chemistry Concentration  
(even-year start)

Fall 2010	CHM 1111	4	Spring 2011	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2011	CHM 3301	4	Spring 2012	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2012	CHM 3321	4	Spring 2013	CHM 3322	4	
	CHM 4421 or Free Elective	3		CHM 4410	1	
	PHY 2211	4		CHM 3341 or Free Elective	3	
	MA 2233	4		ENG 3313	3	
				Gen. Ed.	3	
		15			14	29
Fall 2013	CHM 4420	3	Spring 2014	CHM 4410	1	
	CHM 4490 or Free Elective	3		CHM 4432 or Free Elective	3	
	Gen. Ed.	6		CHM 4431	4	
	Free Elective	3		Gen. Ed.	3	
				Free Electives	4	
		15			15	30
				Total		120

## B.S. Chemistry, Chemistry Concentration

General Education Requirements

Core Requirements	Grade	Date
UNV 1100		
COM 1101		
ENG 1112		
ENG 3313		
Fine Arts:		
Wellness:		

## Group 1: Humanities


## Group 2: Languages and Literature


## Group 3: Mathematics (met by major requirements)

## Group 4: Natural Sciences (met by major requirements)

## Group 5: Social Sciences


## Group 6: General Education Electives (met by major requirements)

## Writing Across the Curriculum (at least one upper-level)


## Information Literacy (upper-level)

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## Global Awareness


Major Requirements

Core Requirements	Grade	Date
CHM 1111		
CHM 1112		
CHM 3301		
CHM 3302		
CHM 3311		
CHM 3321		
CHM 3332		
CHM 4410		
CHM 4410		
MA elective:		
MA 2231		
MA 2232		
PHY 2210		
PHY 2211		

## Concentration requirements

CHM 3322		
CHM 4420		
CHM 4431		
CHM elective:		
CHM elective:		
(choose electives from 3341, 4421, 4432)		
MA 2233		

Graduation Requirements

120 credits		
48 credits upper-level (program provides 42-43), two additional upper-level courses (minimum 6 credits):		

B.S. Chemistry, Forensic Science Concentration  
(odd-year start)

Fall 2011	CHM 1111	4	Spring 2012	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2012	CHM 3301	4	Spring 2013	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		SCI 1104	3	
		15			15	30
Fall 2013	CHM 4420	3	Spring 2014	CHM 3264	3	
	PHY 2211	4		CHM 4410	1	
	PHY 3264	3		CHM 4431 or Free Elective	3	
	MA 2233	4		ENG 3313	3	
				Gen. Ed.	6	
		14			16	30
Fall 2014	CHM 3321	4	Spring 2015	CHM 3322 or Gen. Ed.	3	
	BI 3370 or Free Elective	3		CHM 3341 or Gen. Ed.	3	
	CJA Elective or Gen. Ed.	3		CHM 4410	1	
	Gen. Ed.	3		CJA Elective or Gen. Ed.	3	
				Free Electives	6	
		13			16	29
				Total		120

B.S. Chemistry, Forensic Science Concentration  
(even-year start)

Fall 2010	CHM 1111	4	Spring 2011	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2011	CHM 3301	4	Spring 2012	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2012	CHM 3321	4	Spring 2013	CHM 3322 or Gen. Ed.	3	
	PHY 2211	4		CHM 3341 or Gen. Ed.	3	
	MA 2233	4		CHM 4410	1	
	CJA Elective or Gen. Ed.	3		ENG 3313	3	
				SCI 1104	3	
		15			13	28
Fall 2013	CHM 4420	3	Spring 2014	CHM 3264	3	
	PHY 3264	3		CHM 4410	1	
	BI 3370 or Free Elective	3		CHM 4431 or Free Elective	3	
	Gen. Ed.	6		CJA Elective or Gen. Ed.	3	
				Free Electives	6	
		15			16	31
				Total		120

## B.S. Chemistry, Forensic Science Concentration

General Education Requirements

Core Requirements	Grade	Date
UNV 1100		
COM 1101		
ENG 1112		
ENG 3313		
Fine Arts:		
Wellness:		

## Group 1: Humanities


## Group 2: Languages and Literature


## Group 3: Mathematics (met by major requirements)

## Group 4: Natural Sciences (met by major requirements)

## Group 5: Social Sciences


## Group 6: General Education Electives (met by major requirements)

## Writing Across the Curriculum (at least one upper-level)


## Information Literacy (upper-level)

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## Global Awareness


Major Requirements

Core Requirements	Grade	Date
CHM 1111		
CHM 1112		
CHM 3301		
CHM 3302		
CHM 3311		
CHM 3321		
CHM 3332		
CHM 4410		
CHM 4410		
MA elective:		
MA 2231		
MA 2232		
PHY 2210		
PHY 2211		

## Concentration requirements

CHM 3264		
CHM 4420		
CHM/BI elective:		
CHM/BI elective:		
(choose electives from BI 3370 or CHM 3322, 3341, or 4431)		
CJA elective:		
(choose electives from CJA 3263, 3336, or 3355)		
MA 2233		
PHY 3264		
SCI 1104		

Graduation Requirements

120 credits		
48 credits upper-level (program provides 45), one additional upper-level course (minimum 3 credits):		

B.S. Chemistry, Biochemistry Concentration  
(odd-year start)

Fall 2011	CHM 1111	4	Spring 2012	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2012	CHM 3301	4	Spring 2013	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2013	CHM 3321	4	Spring 2014	CHM 4410	1	
	CHM 4420 or Gen. Ed.	3		CHM 4431 or Gen. Ed.	3	
	BI 3370	4		BI Elective	3	
	PHY 2211	4		ENG 3313	3	
				Free Elective	3	
		15			13	28
Fall 2014	CHM 4421 or Gen. Ed.	3	Spring 2015	CHM 3322 or Gen. Ed.	3	
	CHM 4490 or Free Elective	3		CHM 3341	4	
	BI Elective	3		CHM 4410	1	
	Gen. Ed.	3		Gen. Ed.	3	
	Free Elective	3		Free Electives	5	
		15			16	31
				Total		120



B.S. Chemistry, Biochemistry Concentration  
(even-year start)

Fall 2010	CHM 1111	4	Spring 2011	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101 or ENG 1112	3		ENG 1112 or COM 1101	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2011	CHM 3301	4	Spring 2012	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2012	CHM 3321	4	Spring 2013	CHM 4410	1	
	CHM 4421 or Gen. Ed.	3		CHM 3322 or Gen. Ed.	3	
	BI 3370	4		CHM 3341	4	
	PHY 2211	4		BI Elective	3	
				ENG 3313	3	
		15			14	29
Fall 2013	CHM 4420 or Gen. Ed.	3	Spring 2014	CHM 4431 or Gen. Ed.	3	
	CHM 4490 or Free Elective	3		CHM 4410	1	
	BI Elective	3		Gen. Ed.	3	
	Gen. Ed.	3		Free Electives	8	
	Free Elective	3				
		15			15	30
				Total		120

## B.S. Chemistry, Biochemistry Concentration

General Education Requirements

Core Requirements	Grade	Date
UNV 1100		
COM 1101		
ENG 1112		
ENG 3313		
Fine Arts:		
Wellness:		

## Group 1: Humanities


## Group 2: Languages and Literature


## Group 3: Mathematics (met by major requirements)

## Group 4: Natural Sciences (met by major requirements)

## Group 5: Social Sciences


## Group 6: General Education Electives (met by major requirements)

## Writing Across the Curriculum (at least one upper-level)


## Information Literacy (upper-level)

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## Global Awareness


Major Requirements

Core Requirements	Grade	Date
CHM 1111		
CHM 1112		
CHM 3301		
CHM 3302		
CHM 3311		
CHM 3321		
CHM 3332		
CHM 4410		
CHM 4410		
MA elective:		
MA 2231		
MA 2232		
PHY 2210		
PHY 2211		

## Concentration requirements

CHM 3341		
CHM 4420 or 4421		
CHM 3322 or 4431		
BI 3370		
BI elective:		
BI elective:		
(choose electives from BI 3310, 3371, 3372, 3374, or 3375)		

Graduation Requirements

120 credits		
48 credits upper-level (program provides 46-48), may need one additional upper-level course (minimum 3 credits):		

B.S. Chemistry, Nanotechnology Concentration  
(odd-year start)

Fall 2011	CHM 1111	4	Spring 2012	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101	3		ENG 1112	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2012	CHM 3301	4	Spring 2013	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2013	CHM 3321	4	Spring 2014	CHM 4410	1	
	CHM 4420 or Free Elective	3		CHM 4431 or Free Elective	3	
	PHY 2211	4		ENG 3313	3	
	MA 2233	4		Gen. Ed.	6	
		15			13	28
Fall 2014	SCI 3270	18	Spring 2015	CHM 3322 or Free Elective	3	
				CHM 4410	1	
				Gen. Ed.	6	
				Free Elective	3	
		18			13	31
				Total		120

B.S. Chemistry, Nanotechnology Concentration  
(even-year start)

Fall 2010	CHM 1111	4	Spring 2011	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101	3		ENG 1112	3	
	UNV 1100	1		Gen. Ed.	6	
	Fine Arts	3				
		14			17	31
Fall 2011	CHM 3301	4	Spring 2012	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	MA 2232	4		PHY 2210	4	
	Gen. Ed.	3		Gen. Ed.	3	
		15			15	30
Fall 2012	CHM 3321	4	Spring 2013	CHM 4410	1	
	CHM 4421 or Free Elective	3		CHM 3332 or Free Elective	3	
	PHY 2211	4		ENG 3313	3	
	MA 2233	4		Gen. Ed.	6	
		15			13	28
Fall 2013	SCI 3270	18	Spring 2014	CHM 4431 or Free Elective	3	
				CHM 4410	1	
				Gen. Ed.	6	
				Free Elective	3	
		18			13	31
				Total		120

## B.S. Chemistry, Nanotechnology Concentration

General Education Requirements

Core Requirements	Grade	Date
UNV 1100		
COM 1101		
ENG 1112		
ENG 3313		
Fine Arts:		
Wellness:		

## Group 1: Humanities


## Group 2: Languages and Literature


## Group 3: Mathematics (met by major requirements)

## Group 4: Natural Sciences (met by major requirements)

## Group 5: Social Sciences


## Group 6: General Education Electives (met by major requirements)

## Writing Across the Curriculum (at least one upper-level)


## Information Literacy (upper-level)

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## Global Awareness


Major Requirements

Core Requirements	Grade	Date
CHM 1111		
CHM 1112		
CHM 3301		
CHM 3302		
CHM 3311		
CHM 3321		
CHM 3332		
CHM 4410		
CHM 4410		
MA elective:		
MA 2231		
MA 2232		
PHY 2210		
PHY 2211		

## Concentration requirements

CHM elective:		
(choose electives from 3322, 4420, 4421, or 4431)		
SCI 3270		

Graduation Requirements

120 credits		
48 credits upper-level (program provides 46-47), one additional upper-level course (minimum 3 credits):		

## B.S.E. Chemistry (odd-year start)

Fall 2011	CHM 1111	4	Spring 2012	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101	3		ENG 1112	3	
	ED 1105	1		PSY 1101	3	
	ED 1110	2		ENG xxxx (Lit. Elective)	3	
	SPE 1001	3				
		16			17	33
Fall 2012	CHM 3301	4	Spring 2013	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	PHY 1191 or PSY 3321	3/4		PHY 1192 or 2210	4	
	MA 1125 or 2232	3		ED 2205	3	
	Fine Arts	3		Gen. Ed.	3	
		17/18			18	35/36
Fall 2013	CHM 3321	4	Spring 2014	CHM 4410	1	
	PHY 2211 or PSY 3321	3		CHM Elective	3	
	ED 3310	3		ED 3313	3	
	ED 3320	3		ENG 3313	3	
	Gen. Ed.	3		SPE 3291	3	
				Gen. Ed.	3	
		16/17			16	32/33
Fall 2014	CHM Elective	3	Spring 2015	CHM 4410	1	
	BI 3370	4		ED 4400	12	
	SPE 2276	3		ED 4400L	0	
	SPE 3352	3				
	Gen. Ed.	3				
		16			13	29
				Total		130

This plan has 130 credits instead of 127 because it adds MA 1165 to the list from pages 6-7. If you feel sufficiently prepared for Calculus I, you may substitute 3 credits of General Education.

## B.S.E. Chemistry (even-year start)

Fall 2010	CHM 1111	4	Spring 2011	CHM 1112	4	
	MA 1165	3		MA 2231	4	
	COM 1101	3		ENG 1112	3	
	ED 1105	1		PSY 1101	3	
	ED 1110	2		ENG xxxx (Lit. Elective)	3	
	SPE 1001	3				
		16			17	33
Fall 2011	CHM 3301	4	Spring 2012	CHM 3302	4	
	CHM 3311	4		CHM 3332	4	
	PHY 1191 or PSY 3321	3/4		PHY 1192 or 2210	4	
	MA 1125 or 2232	3		ED 2205	3	
	Fine Arts	3		Gen. Ed.	3	
		17/18			18	35/36
Fall 2012	CHM 3321	4	Spring 2013	CHM 4410	1	
	PHY 2211 or PSY 3321	3/4		CHM Elective	3	
	ED 3310	3		ED 3313	3	
	ED 3320	3		ENG 3313	3	
	Gen. Ed.	3		SPE 3291	3	
				Gen. Ed.	3	
		16/17			16	32/33
Fall 2013	CHM Elective	3	Spring 2014	CHM 4410	1	
	BI 3370	4		ED 4400	12	
	SPE 2276	3		ED 4400L	0	
	SPE 3352	3				
	Gen. Ed.	3				
		16			13	29
				Total		130

This plan has 130 credits instead of 127 because it adds MA 1165 to the list from pages 6-7. If you feel sufficiently prepared for Calculus I, you may substitute 3 credits of General Education.

## B.S.E. Chemistry

General Education Requirements

Core Requirements	Grade	Date
COM 1101		
ED 1105		
ENG 1112		
ENG 3313		
Fine Arts:		
Wellness:		
Group 1: Humanities		
Group 2: Languages and Literature		
Lit. elective: ENG		
Group 3: Mathematics		
MA 2231		
Group 4: Natural Sciences		
CHM 1111		
PHY 1191 or 2210		
Group 5: Social Sciences		
ED 2205		
PSY 1101		
PSY 3321		
Group 6: General Education Electives		
CHM 1112		
MA 1125 or 2232		
PHY 1192 or 2211		
Writing Across the Curriculum (at least one upper-level)		
Information Literacy (upper-level)		
Global Awareness		

Major Requirements

	Grade	Date
BI 3370		
CHM 3301		
CHM 3302		
CHM 3311		
CHM 3321		
CHM 3332		
CHM 4410		
CHM 4410		
CHM elective:		
CHM elective:		
(choose electives from 3322, 3341, 3352, 4420, 4421, 4431, or 4432)		
ED 1110		
ED 3310		
ED 3313		
ED 3320		
ED 4400		
ED 4400L		
SPE 1001		
SPE 2276		
SPE 3291		
SPE 3352		

Graduation Requirements

120 credits	
48 credits upper-level (program provides 58)	



## CHEMISTRY/PHYSICS COURSE DESCRIPTIONS

For other course descriptions (BI, MA, SCI, etc.), consult the current catalog.

\*CHM 1111 GENERAL CHEMISTRY I 4 cr. [3, 0, 3]

For science majors. A study of the fundamental principles of chemistry from the standpoint of stoichiometry, gases, states of matter, solution reactions, bonding, atomic and molecular structure. Laboratory sessions stress the chemical principles discussed in the lecture.

\*CHM 1112 GENERAL CHEMISTRY II 4 cr. [3, 0, 3]

A continuation of 1111: kinetics, thermodynamics, oxidation-reduction, acid-base theory and equilibrium are studied. Prerequisite: CHM 1111.

CHM 3264 CHEM MTDS FOREN SCI 3 cr. [2, 0, 2]

An advanced treatment of the chemical methods used in the investigation of criminal activities. The use and reliability of chemical tests, solubilities, and reactions as well as the chemistry of chromatographic, spectroscopic and instrumental analysis will be included. Prerequisites: CHM 1110, SCI 1104, SCI 1107.

CHM 3301 ORGANIC CHEMISTRY I 4 cr. [3, 0, 4]

Fundamentals of organic chemistry are presented. Modern theory, reaction mechanisms and stereochemistry are included along with nomenclature, preparation, reactions and properties of organic compounds. The laboratory stresses syntheses, chemical and physical properties and an introduction to instrumental techniques. The laboratory period includes one hour of lecture on theory and techniques of laboratory operations. Prerequisite: CHM 1112.

CHM 3302 ORGANIC CHEMISTRY II 4 cr. [3, 0, 4]

A continuation of 3301. The laboratory period includes one hour of lecture on theory and techniques of laboratory operations. Prerequisite: CHM 3301.

CHM 3311 QUANTITATIVE ANALYSIS 4 cr. [3, 0, 4]

An introductory course in analytical chemistry emphasizing classical titrimetric and gravimetric methods and related theories. Prerequisite: CHM 1112.

CHM 3321 PHYSICAL CHEMISTRY I 4 cr. [3, 0, 4]

An introduction to the methods and topics of physical chemistry. Topics include introduction to thermodynamics, equilibria, kinetics, atomic structure, and molecular spectroscopy. Prerequisite: CHM 1112, 3302, MA 2231, PHY 2210 and 2211.

CHM 3322 PHYSICAL CHEMISTRY II 4 cr. [3, 0, 4]

A continuation of 3321. Advanced study of the methods and topics covered in physical chemistry I. MA 2233 is required. Prerequisite: CHM 3321 and MA 2232.

CHM 3332 INSTRUMENTAL ANALYSIS 4 cr. [3, 0, 4]

Deals with the principles and applications of instrumental methods in chemical analysis. Studies include electroanalytical, spectrophotometric, and chromatographic techniques. Prerequisite: CHM 3311.

CHM 3341 BIOCHEMISTRY 4 cr. [3, 0, 3]

A study of carbohydrates, lipids, proteins, enzymes, nucleic acids, vitamins, and hormones in terms of structure, function, and synthesis in living systems. The laboratory includes the isolation, identification, and chemical behavior of biochemically important molecules. Prerequisite: CHM 3302 or permission of instructor.

**CHM 4410 SEMINAR** 1 cr. [1, 0, 0]

Deals with reports emphasizing chemical literature searches and/or current research.

Prerequisite: upper division chemistry major.

**CHM 4420 QUALITATIVE ORGANIC CHEMISTRY** 3 cr. [2, 0, 4]

The identification of organic compounds by various classical and instrumental techniques. Prerequisite: CHM 3302.

**CHM 4421 ADVANCED ORGANIC CHEMISTRY** 3 cr. [3, 0, 0]

An advanced lecture course designed to deepen and expand knowledge in the field.

Topics such as reactions, mechanisms, reactive intermediates, photochemistry, kinetics, stereochemistry, natural products, and spectroscopy may be stressed. Prerequisite: CHM 3302 and 3321.

**CHM 4431 ADVANCED INORGANIC CHEMISTRY** 4 cr. [3, 0, 4]

A presentation of atomic structure and periodic properties. In addition to other topics; valence bond, molecular orbital, crystal and ligand field theories are treated.

Laboratory sessions include one hour of lecture on theory and techniques in the preparation of representative compounds. Prerequisite: CHM 1112 and 3321.

**CHM 4432 STRUCTURAL CHEMISTRY** 3 cr. [3, 0, 0]

The symmetry and structural properties of molecular systems are utilized to determine their energy levels. The electronic and vibrational spectroscopic properties of these systems will be predicted also utilizing symmetry properties. These spectra-structure correlations will be made on organic and inorganic systems. Prerequisite: CHM 3302 and 3321.

**CHM 4490 PROBLEMS IN CHEMISTRY** 1 - 3 cr. [0, 0, variable]

Involves the student in study projects under the direct supervision of an instructor.

Library and laboratory research in selected problems. Prerequisite: Permission of instructor. May be taken for one through three credits.

**\*PHY 1191 PHYSICS I** 4 cr. [3, 1, 2]

A one-year sequential calculus physics course discussing classical mechanics, fluids, thermodynamics, classical electricity and magnetism, optics and waves, modern physics. Application of physics to life science is made in problem selection and laboratory experimentation. Corequisite: MA 2231.

**\*PHY 1192 PHYSICS II** 4 cr. [3, 1, 2]

Continuation of PHY 1191. Prerequisite: PHY 1191.

**\*PHY 2210 GENERAL PHYSICS I** 4 cr. [3, 1, 2]

A calculus based, introductory physics course emphasizing classical concepts. Selected topics include: motion, work and energy, gravitation, electricity and magnetism, and electromagnetic waves. Prerequisite: MA 2231. Co-requisite: MA 2232.

**\*PHY 2211 GENERAL PHYSICS II** 4 cr. [3, 1, 2]

Continuation of PHY 1191 or 2210. Corequisite MA 2233.

**PHY 3264 PHYSICAL METHODS IN FORENSIC SCIENCE** 3 cr. [2, 0, 2]

An advanced treatment of the physical methods used in the investigation of criminal activities. Topics covered include: statistical treatment of data, material properties of matter, ballistics, hair and fiber identification, physical markings, and spectral analysis. Prerequisites: CHM 1110, SCI 1104, SCI 1107