Fiscal Unit/Academic Org	Chemistry - D0628
Administering College/Academic Group	Arts And Sciences
Co-adminstering College/Academic Group	
Semester Conversion Designation	Converted with minimal changes to program goals and/or curricular requirements (e.g., sub-plan/specialization name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)
Current Program/Plan Name	Chemistry
Proposed Program/Plan Name	Chemistry Bachelor of Science major
Program/Plan Code Abbreviation	CHEM-BS
Current Degree Title	Bachelor of Science

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		58	38.7	42	3.3
Required credit hours offered by the unit	Minimum	53	35.3	37	1.7
	Maximum	58	38.7	42	3.3
Required credit hours offered outside of the unit	Minimum	0	0.0	0	0.0
	Maximum	10	6.7	8	1.3
Required prerequisite credit hours not included above	Minimum	55	36.7	37	0.3
	Maximum	55	36.7	37	0.3

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- 1. Students solve state-of-the-art chemistry problems, working both individually and in groups, and these problems will exemplify current disciplinary and interdisciplinary principles as well as modern pedagogical practice.
- 2. Students develop effective skills in oral and written communication of scientific knowledge.
- 3. Students plan experimental procedures, carry out chemical procedures, use laboratory equipment, analyze data and prepare laboratory reports that reinforce current chemical practices.
- 4. Students follow safe practices in the laboratory and demonstrate scientifically ethical practices.
- 5. Students retrieve information from the chemical literature, and become proficient in online database searching.
- 6. Students use modern computer software for graphing, manipulation of symbolic mathematical expressions, and quantum chemical calculations.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? Yes

Summarize how the program's current quarter-based assessment practices will be modified, if necessary, to fit the semester calendar.
No modifications are planned or required to fit the semester calendar.

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- Chemistry_BS_major_v4.pdf: Chemistry BS major

  (Program Proposal. Owner: Hadad,Christopher Martin)

- Chemistry BS cover letter.doc: NMS Division of Arts and Sciences cover letter

  (Letter from the College to OAA. Owner: Andereck,Claude David)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Hadad,Christopher Martin	03/31/2011 11:26 PM	Submitted for Approval
Approved	Hadad,Christopher Martin	03/31/2011 11:27 PM	Unit Approval
Revision Requested	Andereck,Claude David	04/05/2011 01:17 PM	College Approval
Submitted	Hadad,Christopher Martin	04/11/2011 02:22 PM	Submitted for Approval
Approved	Hadad,Christopher Martin	04/11/2011 02:23 PM	Unit Approval
Revision Requested	Andereck,Claude David	04/14/2011 10:29 AM	College Approval
Submitted	Hadad,Christopher Martin	04/16/2011 03:48 PM	Submitted for Approval
Approved	Hadad,Christopher Martin	04/16/2011 03:48 PM	Unit Approval
Approved	Andereck,Claude David	04/19/2011 11:26 AM	College Approval
Pending Approval	Nolen,Dawn Jenkins,Mary Ellen Bigler Meyers,Catherine Anne Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay	04/19/2011 11:26 AM	ASCCAO Approval

College of Arts and Sciences

186 University Hall
230 North Oval Mall
Columbus, OH 43210

Phone (614) 292-8908
Fax (614) 247-7498

April 19, 2011

Larry Krissek
Chair, Arts and Sciences CCI

Dear Larry:

It is a pleasure to forward to you the proposal for the Bachelor of Science in Chemistry under semesters. The program has been converted in a relatively straightforward manner. There have been changes to the laboratory courses, the most important being to allow students to take the organic chemistry laboratories concurrently with the lectures. A second important change has been to offer a version of organic chemistry for majors, in addition to the standard and honors versions—this had already occurred for the introductory sequence.

Beyond my own review of the documents, the proposal has been discussed by colleagues from other NMS units at a meeting on April 5, 2011. Feedback from these discussions has been incorporated in the proposal.

If you have any questions, I would be happy to address them.

Sincerely,

David Andereck
Professor of Physics
Associate Dean of Natural and Mathematical Sciences, College of Arts and Sciences

Department of Chemistry
Newman and Wolfrom Laboratory
100 West 18th Avenue
Columbus, OH 43210-1185

www.chemistry.ohio-state.edu

April 11, 2011

To: University Semester Conversion Committees

Re: Conversion of Undergraduate Major (B.A. and B.S.) and Minor Programs in Chemistry

The Department of Chemistry currently offers a Bachelor of Arts (BA) and a Bachelor of Science (BS) degree as part of our majors program, along with a minor in Chemistry. Our currently offered majors programs prepare students for a variety of careers, with the BA degree being less intensive in required chemistry courses, thereby offering opportunities for undergraduate students to expand their schedules with interdisciplinary courses. Historically, our BA degree has been the most popular with students who are intending to pursue pre-professional programs (pre-medicine, pre-dental, pre-veterinary, pre-pharmacy, pre-optometry, pre-law, etc) or for chemistry-related employment, including sales and marketing. The BS degree requires more chemistry and mathematics courses and is better preparation for a student going off to graduate school in a chemically related discipline (chemistry, biochemistry, pharmacy, etc) or for employment in chemistry (pharmaceutical or materials chemistry). While there is some variation from year to year, there are about 450 chemistry majors across all ranks in 2011, and approximately 50% of them are intending on the BA degree while 50% are working towards the BS degree.

The American Chemical Society (ACS: www.acs.org) provides guidelines for the educational preparation for BS degrees in Chemistry, and the department is currently certified to comply with those guidelines. The ACS only provides guidelines for BS Chemistry degrees. For some institutions, there are significant guidelines as to contact hours by instructors and so on; however, for a large university like Ohio State, the most important aspects of the guidelines are a minimum amount of hours (400) in the chemistry laboratory across the entire BS degree (but excluding first-year general chemistry), a minimum exposure to laboratory experience in 4 of the 5 major areas of chemistry (analytical, biological, inorganic, organic and physical) as well as lecture instruction in all 5 areas.

On a yearly basis, the department provides an update report to the ACS as to our current program and its requirements, and on a 5-year schedule, we re-apply for re-certification of our major programs. Thus, upon graduation, our BS majors can receive a certified ACS degree if they comply with the ACS requirements. Between 25 – 50% of our BS majors per year receive ACS certified degrees.

Our program continues to grow, with approximately 200% more chemistry majors as new first quarter freshmen (NFQFs) in autumn 2010 as compared to a typical number of 35–40 incoming students in the 1990s.

The process for the conversion of our undergraduate major and minor programs began in summer 2010 with many discussions with our faculty and teaching staff. The courses were discussed at numerous meetings of the faculty at large as well as the Undergraduate Curriculum Committee, chaired by the Vice Chair for Undergraduate Studies (Christopher Hadad). On December 10, 2010, the Undergraduate Curriculum Committee unanimously voted to adopt the envisioned programs presented here for the revised undergraduate programs under semesters. Then, the faculty voted on the same programs at a January 19, 2011 faculty meeting and voted 25 in favor, 0 against and 0 abstain to adopt these revisions to our programs.

The details of these revised programs are provided in the accompanying documentation.

If you have any questions, please contact Christopher Hadad at (614) 292–1204 or hadad.1@osu.edu.

Sincerely,

Malcolm H. Chisholm
Chair and Distinguished University Professor
Department of Chemistry

Christopher M. Hadad
Vice Chair for Undergraduate Studies
Department of Chemistry

Program Rationale Statement (Bachelor of Science degree in Chemistry)

The revised program for the Bachelor of Science (BS) degree in Chemistry is a relatively straightforward conversion of our existing BS degree under quarters. Our learning goals and outcomes have been abbreviated in terms of language as compared to the current assessment plan; however, the goals are relatively invariant.

Approximately half of our current majors are working towards the BS degree. We maintain core experiences in general, analytical, organic, inorganic and physical chemistry. Exposure to biochemistry is strongly encouraged and would fulfill an advanced science elective (shown as a course in the third year). Advanced science electives can be fulfilled by pre-professional students who require a specific course in biochemistry. Relative to our BS degree under quarters, we continue to require similar content in mathematics (through differential equations, Math 2255) and a year of physics (1250–1251).

The most significant changes to our program relate to our laboratory courses. Many of our laboratory courses (for example, analytical, inorganic and physical chemistry courses) were one-quarter offerings, and these quarter offerings are now expanded to one-semester courses (analytical: 2210; physical: 4410; inorganic: 4550). Our organic laboratory courses were two-quarter sequences (254–255), but previously required a pre-requisite one-quarter lecture course (251). With semesters, we cannot require this pre-requisite lecture course, and our semester organic lab offerings (2540–2550) must be offered concurrent with lecture (2510–2520 or 2610–2620 or 2910H–2920H). Thus, these lab offerings had to be adjusted in terms of our current two 3-hour (or 4-hour) lab meetings per week to be only one 3-hour (or 4-hour) lab meeting per week. Overall, our new semester plan is commensurate with semester offerings by peer institutions.

The American Chemical Society provides guidelines for an ACS certified BS degree. Specifically, to be certified, the student should have a minimum amount of hours in laboratory courses (beyond general chemistry) and be exposed to all areas of chemistry (analytical, biological, inorganic, organic and physical) in a lecture format and also have a laboratory experience in at least 4 of the 5 areas. Thus, if a BS chemistry major follows our suggested course sequences and takes biochemistry as an elective, they will have the correct breadth of lecture (5) and laboratory (4) experiences as well as the minimum laboratory hours (400) to obtain a BS degree certified by the ACS. Moreover, a chemistry research experience (4998/4999 as well as the honors variants) can complement the course-based laboratory hours for ACS certification.

Research remains a highly recommended and encouraged science elective.

Another change is an extension of our current effort to have a majors-only version of our high-enrollment courses. Until only recently, our Chemistry majors have been able to take our Honors sequence (201H–202H–203H) or the regular sequence (121–122–123) of general chemistry. In 2009, we created a new general chemistry sequence for chemistry (and biochemistry) majors: 161–162–163. These options have been maintained for general chemistry under semesters (honors, majors-only, and regular sequences). Organic chemistry has been a similar challenge

with our 100+ chemistry majors immersed in a sea of 1500+ (predominantly pre-professional) students. While Honors organic chemistry was an option, there was no majors-only version of organic chemistry. For semesters, we have created a 2610–2620 organic sequence for chemistry (and biochemistry) majors, along with retention of our honors (2910H–2920H) and regular (2510–2520) sequences. We anticipate that content of pertinent relevance to chemistry (and biochemistry) majors will be provided in the majors-only sequence (for example, state-of-the-art methodologies in carbon-carbon bond-forming reactions as well as asymmetric and catalytic processes).

We do not have specializations or subprograms for our BS degree; instead, from one-on-one discussions between the undergraduate student and our chemistry advisors, we create the ideal program of courses that will cater to the specific interests of the student. For example, a chemistry major who plans to go to graduate school in organic chemistry would be advised to take some additional courses above 5000 level in organic chemistry prior to graduation. Those 5000-level courses would count as advanced science electives in the senior year.

With regard to the four-year plan, the Bachelor of Science curriculum is designed for students seeking to become professional chemists. Chemistry 1610 – 1620 is the recommended general chemistry sequence for chemistry majors who present high school chemistry for entrance, although qualified students are strongly urged to take the honors general chemistry sequence, Chemistry 1910H – 1920H, instead. (Chemistry 1210 – 1220 are acceptable, but are not the preferred sequence for chemistry majors.)

Chemistry 1620 or 1920H is followed by Organic Chemistry and Quantitative Analysis 2210 (or 2210H) in the second year. As with general chemistry, Chemistry 2610 – 2620 is the recommended organic chemistry lecture sequence for chemistry majors, although qualified students are strongly urged to take the honors sequence, Chemistry 2910H – 2920H, instead. (Chemistry 2510 – 2520 are acceptable, but are not the preferred organic lecture sequence for chemistry majors.) The Organic Chemistry lab experience is either the 2540 – 2550 sequence or the honors version (2940H – 2950H).

Physical Chemistry 4300 – 4310; Physical Chemistry Laboratory 4410; Instrumental Analysis 4870; and Inorganic Chemistry 3510 are taken in the third year. The laboratory component on Instrumental Analysis (Chemistry 4880) is taken in the fourth year. An advanced lab, Undergraduate Research (Chemistry 4998/4999), Honors Research (Chemistry 4998H/4999H), or Biochemistry 4511 is taken in the fourth year or earlier.

The major is completed with 6 hours of advanced science electives, which must include at least three hours of chemistry courses. Advanced science electives must be approved by the undergraduate chemistry advisors. Examples of some approved science electives include: Chemistry 4998/4999 and any un-required graded 5000 or 6000 level courses in Chemistry; any 4000 or 5000 level course in Physics; Biochemistry 4511; most 4000 or 5000 level courses in Mathematics. Not more than six hours of Chemistry 4998/4999 (or honors versions) may be used to fulfill requirements of the major. Students who wish to receive a degree certified by the American Chemical Society should include Biochemistry 4511 (4 credit hours) and an advanced

lab experience in Inorganic Chemistry (4550, 2 credit hours) or Biochemistry (5621, 4 credit hours) in their course choices for the major.

While we show a typical sequence of courses, we will offer many of these course offerings in both the autumn and spring quarters so that students can adjust their schedules for their particular needs. We anticipate that an undergraduate student who starts with general chemistry in their first year will have little difficulty in graduating in 4 years under semesters.

Bachelor of Science Degree in Chemistry – Typical Plan for Students with 4 Years on Semesters

Freshman Year (Semesters)				Total
Autumn		**Spring**		
General Chemistry 1 (1910H, 1610, 1210)	5	General Chemistry 2 (1920H, 1620, 1220)	5	
Calculus 1 (Math 1151)	5	Calculus 2 (Math 1152)	5	
GE Elective (e.g. biological science)	4	GE Elective	3	
GE Elective	3	GE Elective	3	
Survey	1			
	18		16	34

Sophomore Year (Semesters)				
Autumn		**Spring**		
Organic Chemistry 1 (2910H, 2610, 2510)	4	Organic Chemistry 2 (2920H, 2620, 2520)	4	
Organic Chemistry Laboratory 1 (2940H, 2540)	2	Organic Chemistry Laboratory 2 (2950H, 2550)	2	
Introductory Physics (calculus-based) I (1250)	5	Introductory Physics (calculus-based) II (1251)	5	
Calculus 3 (Math 2153)	4	Analytical Chemistry 1 (2210H, 2210)	5	
	15		16	31

Junior Year (Semesters)				
Autumn		**Spring**		
Physical Chemistry 1 (4300)	3	Physical Chemistry 2 (4310)	3	
Inorganic Chemistry (3510)	3	Physical Chemistry Laboratory (4410)	3	
Advanced Science Elective (e.g. Biochem 4511[a])	3	Analytical Chemistry 2: Instrumental Analysis (4870)	3	
Differential Equations (Math 2255)	3	Advanced Lab (Inorganic Lab 4550/Biochem 5621[b])	2	
GE Elective	3	GE Elective	3	
	15		14	29

Senior Year (Semesters)				
Autumn		**Spring**		
Advanced Chemistry Elective	3	Elective	3	
Laboratory Practice in Instrumental Analysis (4880)	2	GE Elective	3	
GE Elective	3	GE Elective	3	
GE Elective	3	GE Elective	3	
GE Elective	3	GE Elective	3	
	14		15	29
				123

[a] Biochemistry 4511 = 4 credit hours

[b] Biochemistry 5621 = 4 credit hours

Bachelor of Science Degree in Chemistry – Plan for Students with 1 Year on Quarters & 3 Years on Semesters

Freshman Year (Quarters)

Autumn		Winter		Spring		
Chemistry 201H, 161, or 121	5	Chemistry 202H, 162, or 122	5	Chemistry 203H, 163, 123	5	
Math 151	5	Math 152	5	Math 153	5	
GEC	5	GEC	5	GEC	5	
Survey	1					
	16		15		15	46
						(31)

Sophomore Year (Semesters)

Autumn		Spring		
Organic Chemistry 1 (2910H, 2610, 2510)	4	Organic Chemistry 2 (2920H, 2620, 2520)	4	
Organic Chemistry Laboratory 1 (2940H, 2540)	2	Organic Chemistry Laboratory 2 (2950H, 2550)	2	
Introductory Physics (calculus-based) I (1250)	5	Introductory Physics (calculus-based) II (1251)	5	
Calculus 3 (Math 2153)	4	Analytical Chemistry 1 (2210H, 2210)	5	
GE Elective	3			
	18		16	34

Junior Year (Semesters)

Autumn		Spring		
Physical Chemistry 1 (4300)	3	Physical Chemistry 2 (4310)	3	
Inorganic Chemistry (3510)	3	Physical Chemistry Laboratory (4410)	3	
Advanced Science Elective (e.g. Biochem 4511[a])	3	Analytical Chemistry 2: Instrumental Analysis (4870)	3	
Differential Equations (Math 2255)	3	Advanced Lab (Inorganic Lab 4550/Biochem 5621[b])	2	
GE Elective	3	GE Elective	3	
	15		14	29

Senior Year (Semesters)

Autumn		Spring		
Advanced Chemistry Elective	3	GE Elective	3	
Laboratory Practice in Instrumental Analysis (4880)	2	GE Elective	3	
Elective	3	GE Elective	3	
GE Elective	3	GE Elective	3	
GE Elective	3	GE Elective	3	
	14		15	29
				123

[a] Biochemistry 4511 = 4 credit hours

[b] Biochemistry 5621 = 4 credit hours

Bachelor of Science Degree in Chemistry – Plan for Students with 2 Years on Quarters & 2 Years on Semesters

Freshman Year (Quarters)

Autumn		Winter		Spring		
Chemistry 201H, 161, or 121	5	Chemistry 202H, 162, or 122	5	Chemistry 203H, 163, or 123	5	
Math 151	5	Math 152	5	Math 153	5	
GEC	5	GEC	5	GEC	5	
Survey	1					
	16		15		15	46
						(31)

Sophomore Year (Quarters)

Autumn		Winter		Spring		
Chemistry 251H or 251	4	Chemistry 252H or 252	4	Chemistry 253H or 253	4	
Chemistry 221H or 221	5	Chemistry 254H or 254	3	Chemistry 255H or 255	3	
Physics 131	5	Physics 132	5	Physics 133	5	
GEC	5	Math 254	5	Math 255	5	
	19		17		17	53
						(35)

Junior Year (Semesters)

Autumn		Spring		
Physical Chemistry 1 (4300)	3	Physical Chemistry 2 (4310)	3	
Inorganic Chemistry (3510)	3	Physical Chemistry Laboratory (4410)	3	
Advanced Science Elective (e.g. Biochem 4511[a])	3	Analytical Chemistry 2: Instrumental Analysis (4870)	3	
GE Elective	3	Advanced Lab (Inorganic Lab 4550/Biochem 5621[b])	2	
GE Elective	3	GE Elective	3	
	15		14	29

Senior Year (Semesters)

Autumn		Spring		
Advanced Chemistry Elective	3	GE Elective	3	
Laboratory Practice in Instrumental Analysis (4880)	2	GE Elective	3	
Elective	3	GE Elective	3	
GE Elective	3	GE Elective	3	
GE Elective	3			
	14		12	26
				121

[a] Biochemistry 4511 = 4 credit hours

[b] Biochemistry 5621 = 4 credit hours

Bachelor of Science Degree in Chemistry – Plan for Students with 3 Years on Quarters & 1 Year on Semesters

Freshman Year (Quarters)

Autumn		Winter		Spring		
Chemistry 201H, 161, or 121	5	Chemistry 202H, 162, or 122	5	Chemistry 203H, 163, 123	5	
Math 151	5	Math 152	5	Math 153	5	
GEC	5	GEC	5	GEC	5	
Survey	1					
	16		15		15	46
						(31)

Sophomore Year (Quarters)

Autumn		Winter		Spring		
Chemistry 251H or 251	4	Chemistry 252H or 252	4	Chemistry 253H or 253	4	
Chemistry 221H or 221	5	Chemistry 254H or 254	3	Chemistry 255H or 255	3	
Physics 131	5	Physics 132	5	Physics 133	5	
GEC	5	Math 254	5	Math 255	5	
	19		17		17	53
						(35)

Junior Year (Quarters)

Autumn		Winter		Spring		
Chemistry 530 (physical lecture)	3	Chemistry 531 (physical lec.)	3	Chemistry 532 (physical lecture)	3	
Chemistry 651 (inorg. lecture)	3	Chemistry 541 (physical lab)	3	Chemistry 587 (instrumental lec.)	3	
GEC	5	Chemistry 652 (inorg. lec.)	3	Advanced Chemistry elective	3	
GEC (e.g. Biology 113)	5	GEC	5	GEC	5	
	16		14		14	44
						(29)

Senior Year (Semesters)

Autumn		Spring		
Advanced Science Elective (e.g. Biochem 4511[a])	3	Advanced Lab (Inorganic Lab 4550/Biochem 5621[b])	2	
Laboratory Practice in Instrumental Analysis (4880)	2	GE Elective	3	
GE Elective	3	GE Elective	3	
GE Elective	3	GE Elective	4	
GE Elective	3			
	14		12	26
				121

[a] Biochemistry 4511 = 4 credit hours

[b] Biochemistry 5621 = 4 credit hours

Bachelor of Science Chemistry Courses for Semesters

Title	*Quarter Course Number*	*Quarter Credits*	*Semester Course Number*	*Semester Credits*	*Course Information (L = lecture, R = recitation, B = lab)*	*Comments*
Pre-requisite Courses for B.S. Chemistry degree						
General Chemistry 1	121	5	1210	5	3 hr L, 1 hr R, 1 x 3 hr B	simple conversion (GEC-lab)
General Chemistry 2	122	5	1220	5	3 hr L, 1 hr R, 1 x 3 hr B	
General Chemistry 3	123	5				
General Chemistry for Majors 1	161	5	1610	5	3 hr L, 1 hr R, 1 x 3 hr B	simple conversion (GEC-lab)
General Chemistry for Majors 2	162	5	1620	5	3 hr L, 1 hr R, 1 x 3 hr B	
General Chemistry for Majors 3	163	5				
Honors General Chemistry 1	201H	5	1910H	5	3 hr L, 1 hr R, 1 x 3 hr B	simple conversion (GEC-lab)
Honors General Chemistry 2	202H	5	1920H	5	3 hr L, 1 hr R, 1 x 3 hr B	
Honors General Chemistry 3	203H	5				
Required Core Chemistry Courses for B.S. Chemistry degree						
Analytical Chemistry 1: Quantitative Analysis	221	5	2210	5	3 hr L, 1 hr R, 1 x 4 hr B	simple conversion (2 x 4 hr B, qtr to 1 x 4 hr B, sem)
Honors Analytical Chemistry 1: Quantitative Analysis	221H	5	2210H	5	3 hr L, 1 hr R, 1 x 4 hr B	simple conversion (2 x 4 hr B, qtr to 1 x 4 hr B, sem)
Organic Chemistry 1	251	4	2510	4	3 hr L, 1 hr R	simple conversion
Organic Chemistry 2	252	4	2520	4	3 hr L, 1 hr R	
Organic Chemistry 3	253	4				
Organic Chemistry Laboratory 1	254	3	2540	2	1.5 hr L, 1 x 4 hr B	simple conversion
Organic Chemistry Laboratory 2	255	3	2550	2	1.5 hr L, 1 x 4 hr B	simple conversion
Organic Chemistry for Majors 1	---	---	2610	4	3 hr L, 1 hr R	NEW course sequence for majors
Organic Chemistry for Majors 2	---	---	2620	4	3 hr L, 1 hr R	
Honors Organic Chemistry 1	251H	4	2910H	4	3 hr L, 1 hr R	simple conversion
Honors Organic Chemistry 2	252H	4	2920H	4	3 hr L, 1 hr R	
Honors Organic Chemistry 3	253H	4				
Honors Organic Chemistry Laboratory 1	254H	3	2940H	2	1.5 hr L, 1 x 4 hr B	simple conversion
Honors Organic Chemistry Laboratory 2	255H	3	2950H	2	1.5 hr L, 1 x 4 hr B	simple conversion
Inorganic Chemistry 1	651	3	3510	3	3 hr L, 1 hr R	selected content
Inorganic Chemistry 2	652	3				
Physical Chemistry 1	530	3	4300	3	3 hr L, 1 hr R	simple conversion

Physical Chemistry 1	530	3	4310	3	3 hr L, 1 hr R	simple conversion
Physical Chemistry 2	531	3				
Physical Chemistry 3	532	3				
Physical Chemistry Laboratory 1	541	3	4410	3	1 hr L, 2 x 3 hr B	simple conversion
Physical Chemistry Laboratory 2	542	3				
Analytical Chemistry 2: Instrumental Analysis	587	3	4870	3	3 hr L	simple conversion
Laboratory Practice in Instrumental Analysis	588	3	4880	2	2 x 3 hr B	simple conversion
Elective Chemistry Courses for B.S. Chemistry degree						
Inorganic Chemistry Laboratory	755	3	4550	2	2 x 3 hr B	simple conversion (undergraduate only)
Spectroscopic Methods in Organic Chemistry	632	3	5420	3	3 hr L	simple conversion
Carbohydrate Chemistry	635	3	5430	3	3 hr L	simple conversion
Atmospheric Chemistry	641	3	6550	1.5	3 hr L	simple conversion
Introduction to Computational Chemistry	644	3	5440	3	3 hr L	simple conversion
Nanochemistry	611	3	5520	3	3 hr L	simple conversion
Introduction to Quantum Chemistry and Spectroscopy	673	3	5730	3	3 hr L	simple conversion
Individual Studies	693	0-15	5193	0-15	arranged	simple conversion
Undergraduate Research	699	1-10	4998	1-10	arranged	undergraduate research (letter grade)
Undergraduate Research (thesis)	699	1-10	4999	1-10	arranged	undergraduate thesis (letter grade)
Honors Research	783H	3-10	4998H	1-10	arranged	honors undergraduate research (letter grade)
Honors Research (thesis)	783H	3-10	4999H	1-10	arranged	honors undergraduate thesis (letter grade)
Survey of Instrumental Methods			6110	1.5	3 hr L	re-envisioned course
Analytical Data Treatment: Statistical and Numerical Analysis			6120	1.5	3 hr L	re-envisioned course
Chemistry at the Interface of Biology			6210	1.5	3 hr L	re-envisioned course
Fundamentals of Coordination			6310	1.5	3 hr L	re-envisioned course

Chemistry						
Synthetic Principles in Inorganic Chemistry			6320	1.5	3 hr L	re-envisioned course
Group Theory and Bonding			6330	1.5	3 hr L	re-envisioned course
Physical Methods in Inorganic Chemistry			6340	1.5	3 hr L	re-envisioned course
Basic Organic Reaction Mechanisms			6410	1.5	3 hr L	re-envisioned course
Stereochemistry and Conformational Analysis			6420	1.5	3 hr L	re-envisioned course
Introduction to Organic Synthesis			6430	1.5	3 hr L	re-envisioned course
Introduction to Physical Organic Chemistry			6440	1.5	3 hr L	re-envisioned course
Quantum Mechanics and Spectroscopy			6510	1.5	3 hr L	re-envisioned course
Thermodynamics			6520	1.5	3 hr L	re-envisioned course
Kinetics			6530	1.5	3 hr L	re-envisioned course
Introduction to Electronic Structure			6540	1.5	3 hr L	re-envisioned course
Electrochemistry	821		7120	3	3 hr L	re-envisioned course
Fundamentals and Techniques of Separation Science	822		7130	3	3 hr L	re-envisioned course
Analytical Spectroscopy	823		7140	3	3 hr L	re-envisioned course
Mass Spectrometry	825		7150	3	3 hr L	re-envisioned course
Nuclear Magnetic Resonance	824		7160	3	3 hr L	re-envisioned course
Analytical Surface Science			7170	1.5	3 hr L	re-envisioned course
Organometallic Chemistry			7320	1.5	3 hr L	re-envisioned course
Solid State Chemistry			7330	1.5	3 hr L	re-envisioned course
Diffraction Methods			7340	1.5	3 hr L	re-envisioned course
Inorganic Photochemistry			7350	1.5	3 hr L	re-envisioned course
Bioinorganic Chemistry			7360	1.5	3 hr L	re-envisioned course
Advanced Nanochemistry			7370	1.5	3 hr L	re-envisioned course
Inorganic Materials			7380	1.5	3 hr L	re-envisioned course
Advanced Inorganic Laboratory	755		7390	1.5	arranged	re-envisioned course
Advanced Organic Synthesis			7430	1.5	3 hr L	re-envisioned course
Kinetics, Catalysis and Transition State Theory			7440	1.5	3 hr L	re-envisioned course
Metals in Organic Synthesis			7450	1.5	3 hr L	re-envisioned course

Advanced Organic Reaction Mechanisms			7460	1.5	3 hr L	re-envisioned course
Computational Chemistry	944		7470	1.5	3 hr L	re-envisioned course
Advanced Organic Synthesis Laboratory	835,836		7480	3	arranged	re-envisioned course
Advanced Molecular Quantum Mechanics and Spectra			7520	3	3 hr L	re-envisioned course
Spectra and Structure of Molecules	866		7530	3	3 hr L	re-envisioned course
Chemical Dynamics	876		7540	3	3 hr L	re-envisioned course
Statistical Thermodynamics	880		7550	3	3 hr L	re-envisioned course
Introduction to Astrochemistry			7560	1.5	3 hr L	re-envisioned course
Aerosol Science			7570	1.5	3 hr L	re-envisioned course
Lasers, Optics and Optical Instrumentation			7580	1.5	3 hr L	re-envisioned course
Molecular Simulations of Materials			7590	3	3 hr L	re-envisioned course

MAJOR PROGRAM FORM
College of the Arts and Sciences

Department of Chemistry

Student:_____ Major: Chemistry – B.S.
Last First Middle

Student No.:_____ Degree Sought: B.S. Advisor:_____

Name.#:_____ Expected Semester and Year of Graduation: _____

Courses	Hours		Semester Taken
Chem 2210 or 2210H	5		
Chem 2510 or 2610 or 2910H	4		
Chem 2520 or 2620 or 2920H	4		
Chem 2540 or 2940H	2		
Chem 2550 or 2950H	2		
Chem 3510	3		
Chem 4300	3		
Chem 4310	3		
Chem 4410	3		
Chem 4870	3		
Chem 4880	2		
Adv. Lab - Chem 4550 or 4998/H (or 4999/H) or Biochem 5621	2		
Adv. Chem Elective			
Adv. Science Elective			

Total Hours:_____

1. You must earn at least a C– in a course in order for it to be listed on your major. However, you must achieve a 2.00 cumulative point-hour ratio for all major course work. If you earn a D+, D, or an E in a course on your major program, the course cannot be counted toward the major. Your chemistry advisor will decide whether you should repeat the course, delete the course from your major, or substitute another course. Courses taken on a pass/non-pass basis may not be used on the major.

2. Elective courses are chosen in consultation with your chemistry advisor. All courses comprising your major must be approved in writing by your chemistry advisor on a form sent to the office of the College of the Arts and Sciences. Changes in your major program may be made only with the written approval of your chemistry advisor. They must be filed in the Arts and Sciences office at the time approval is given.

Courses required to support the major:

General Chem 1	1210 _____	or	1610 _____	or	1910H _____		
General Chem 2	1220 _____	or	1620 _____	or	1920H _____		
Math	1151 _____		1152 _____		2153 _____	2255 _____	
Physics	1250 _____		1251 _____				

_____ Chemistry 614-292-1204
Signature of Advisor Date Department Campus Phone

Copies to: **College Office** - white **Advisor** - gold **Student** - pink

The Bachelor of Science Degree in Chemistry (B.S.)

The Bachelor of Science curriculum is designed for students seeking to become professional chemists. Chemistry 1610 – 1620 is the recommended general chemistry sequence for chemistry majors who present high school chemistry for entrance, although qualified students are strongly urged to take the honors general chemistry sequence, Chemistry 1910H – 1920H, instead. (Chemistry 1210 – 1220 are acceptable, but are not the preferred sequence for chemistry majors.) Chemistry 1620 or 1920H is followed by Organic Chemistry and Quantitative Analysis 2210 (or 2210H) in the second year. As with general chemistry, Chemistry 2610 – 2620 is the recommended organic chemistry lecture sequence for chemistry majors, although qualified students are strongly urged to take the honors sequence, Chemistry 2910H – 2920H, instead. (Chemistry 2510 – 2520 are acceptable, but are not the preferred organic lecture sequence for chemistry majors.) The Organic Chemistry lab experience is either the 2540 – 2550 sequence or the honors version (2940H – 2950H). Physical Chemistry 4300 – 4310; Physical Chemistry Laboratory 4410; Instrumental Analysis 4870; and Inorganic Chemistry 3510 are taken in the third year. The laboratory component on Instrumental Analysis (Chemistry 4880) is taken in the fourth year. An advanced lab, Undergraduate Research (Chemistry 4998/4999), Honors Research (Chemistry 4998H/4999H), or Biochemistry 4511 is taken in the fourth year or earlier. The major is completed with **6 hours of advanced science electives**, which must include **at least three hours of chemistry courses**. Advanced science electives must be approved by the undergraduate chemistry advisors. Examples of some approved science electives include: Chemistry 4998/4999 and any un-required graded 5000 or 6000 level courses in Chemistry; any 4000 or 5000 level course in Physics; Biochemistry 4511; most 4000 or 5000 level courses in Mathematics. Not more than six hours of Chemistry 4998/4999 (or honors versions) may be used to fulfill requirements of the major. Students who wish to receive a degree certified by the American Chemical Society should include Biochemistry 4511 (4 credit hours) and an advanced lab experience in Inorganic Chemistry (4550, 2 credit hours) or Biochemistry (5621, 4 credit hours) in their course choices for the major. A **sample curriculum** for semesters is given below. Your advisors will work with you to design your ideal curriculum. You may take your general elective (GE) courses in a much different order than is shown here. Check with your chemistry advisor to design a schedule for your chemistry, math, physics, and other science courses.

Autumn Semester (Year 1)		**Spring Semester (Year 1)**	
General Chemistry 1 (1910H, 1610, 1210)	5	General Chemistry 2 (1920H, 1620, 1220)	5
Calculus 1 (Math 1151)	5	Calculus 2 (Math 1152)	5
GE Elective (e.g. biological sciences)	4	GE Elective	3
GE Elective	3	GE Elective	3
Survey	1		
	18		16
Autumn Semester (Year 2)		**Spring Semester (Year 2)**	
Organic Chemistry 1 (2910H, 2610, 2510)	4	Organic Chemistry 2 (2920H, 2620, 2520)	4
Organic Chemistry Laboratory 1 (2940H, 2540)	2	Organic Chemistry Laboratory 2 (2950H, 2550)	2
Introductory Physics (calculus-based) I (1250)	5	Introductory Physics (calculus-based) II (1251)	5
Calculus 3 (Math 2153)	4	Analytical Chemistry 1 (2210H, 2210)	5
	15		16
Autumn Semester (Year 3)		**Spring Semester (Year 3)**	
Physical Chemistry 1 (4300)	3	Physical Chemistry 2 (4310)	3
Inorganic Chemistry (3510)	3	Physical Chemistry Laboratory (4410)	3
Advanced Science Elective (e.g. Biochem 4511[a])	3	Analytical Chemistry 2: Instrumental Analysis (4870)	3
Differential Equations (Math 2255)	3	Advanced Lab (Inorganic 4550/Biochem 5621[b])	2
GE Elective	3	GE Elective	3
	15		14
Autumn Semester (Year 4)		**Spring Semester (Year 4)**	
Advanced Chemistry Elective	3	Elective	3
Laboratory Practice in Instrumental Analysis (4880)	2	GE Elective	3
GE Elective	3	GE Elective	3
GE Elective	3	GE Elective	3
GE Elective	3	GE Elective	3
	14		15

[a] Biochemistry 4511 = 4 credit hours

[b] Biochemistry 5621 = 4 credit hours

MAJOR PROGRAM FORM

Colleges of the Arts and Sciences, The Ohio State University

Student: _____ Major: Chemistry - B.S.
Last First Middle

Student No.: _____ Degree Sought: B.S. Advisor: _____

Columbus Address: _____

Telephone No.: _____ Name .n: _____ Expected Qtr. and Yr. of Graduation: _____

Courses	Hours	Quarter Taken
Chem 221	5	
Chem 251	4	
Chem 252	4	
Chem 253	4	
Chem 254	3	
Chem 255	3	
Chem 530	3	
Chem 531	3	
Chem 532	3	
Chem 541	3	
Chem 699 or 755 (or H783)	3	
Chem 587	3	
Chem 588	3	
Chem 651	3	
Chem 652	3	
Chem (Adv. Sci. Elective)		
(Adv. Sci. Elective)		
(Adv. Sci. Elective)		
Total Hours:		

1. You must earn at least a C– in a course in order for it to be listed on your major. However, you must achieve a 2.00 cumulative point-hour ratio for all major course work. If you earn a D+, D, or an E in a course on your major program, the course cannot be counted toward the major. Your faculty adviser will decide whether you should repeat the course, delete the course from your major, or substitute another course. Courses taken on a pass/non-pass basis may not be used on the major.
2. All courses comprising your major must be approved in writing by your faculty adviser on a form sent to the office of the Colleges of the Arts and Sciences. Changes in your major program may be made only with the written approval of your faculty adviser. They must be filed in the Arts and Sciences office at the time approval is given.

Courses required to support the major:

Math 151_____ 152_____ 153_____ 254_____ 255_____
Physics 131_____ 132_____ 133_____

_____ _____
Signature of Advisor Date

Chemistry 292-1204
Department Campus Phone

Copies to: **Advisor** - Canary **College Office** - white **Student** - pink

The Ohio State University
Form 10530 - Rev. 3/09

The Bachelor of Science Degree in Chemistry (B.S.)

The Bachelor of Science curriculum is designed for students seeking to become professional chemists. Chemistry 161, 162, and 163 is the recommended general chemistry sequence for chemistry majors who present high school chemistry for entrance, although qualified students are strongly urged to take the honors general chemistry sequence, Chemistry 201H, 202H and 203H, instead. (Chemistry 121, 121, and 123 are acceptable, but not the preferred sequence for chemistry majors.) Chemistry 163 or 203H is followed by Quantitative Analysis 221 (or 221H) and Organic Chemistry 251 through 255 (or 251H-255H) in the second year. Physical Chemistry 530 through 532; Physical Chemistry Laboratory 541; Instrumental Analysis 587 and 588; and Inorganic Chemistry 651 and 652 are taken in the third year. An advanced lab, Undergraduate Research Chem 699, Honors Research Chem 783H, or Biochem 521 is taken in the fourth year or earlier. The major is completed with **8 hours of advanced science electives,** which must include **at least three hours of chemistry courses.** Advanced science electives must be approved by the undergraduate chemistry advisor. Examples of some approved science electives include: Chemistry 699 and any unrequired graded 600 or 700 level courses in Chemistry; any 500 or 600 level course in Physics; Biochemistry 511; most 400 or 500 level courses in Mathematics; Chemical Engineering 520, 521, and 610. Not more than nine hours of Chemistry 699 may be used to fulfill requirements of the major. Students who wish to receive a degree certified by The American Chemical Society should include Biochemistry 511 and an advanced lab experience in Inorganic or Biochemistry in their course choices for the major. A **sample curriculum** based on the quarter system is given below. The curriculum will change when Ohio State changes to semesters in Summer 2012, although the overall curriculum content will be very similar. Your advisers will work with you to design a curriculum transition plan. You may take your GEC courses in a much different order than is shown here. Check with your chemistry advisor to design a schedule for your chemistry, math, physics, and other science courses.

Autumn First Year		Winter First Year		Spring First Year	
Chem 201H, 161, or 121	5	Chem 202H, 162, or 122	5	Chem 203H, 163, or 123	5
Math 151	5	Math 152	5	Math 153	5
GEC-social science	5	GEC-arts & hum (VPA)	5	GEC-English 110	5
	15		15		15
Autumn Second Year		**Winter Second Year**		**Spring Second Year**	
Chem 221H or 221 (quant)	5	Chem 252H or 252 (org. lec)	4	Chem 253H or 253 (org. lec)	4
Chem 251H or 251 (org. lec)	4	Chem 254H or 254 (org. lab)	3	Chem 255H or 255 (org. lab)	3
Physics 131	5	Physics 132	5	Physics 133	5
GEC-2nd writing course	5	Math 254	5	Math 255	5
	19		17		17
Autumn Third Year		**Winter Third Year**		**Spring Third Year**	
Chem 530 (p. chem lec)	3	Chem 531 (p. chem lec)	3	Chem 532 (p. chem lec)	3
Chem 651 (adv. inorg lec)	3	Chem 541 (p. chem lab)	3	Chem 587 (instrum. lec)	3
GEC-foreign language	5	Chem 652 (adv. inorg lec)	3	Chem 588 (instrum. lab)	3
Biol. 113 GEC-nat. sci	5	GEC-foreign language	5	GEC-foreign language	5
	16		14		14
Autumn Fourth Year		**Winter Fourth Year**		**Spring Fourth Year**	
Advanced chemistry elective	3	Chem 699 or 783H or Biochem 521	3-5	Advanced science elective	3
GEC-foreign language	5	Advanced science elective	3	GEC-history	5
GEC-arts & hum (Lit)	5	GEC-history	5	GEC-social science	5
	13	Elective	5		13
			16-18		

The GEC Social Diversity and International Issues requirements should be fulfilled by selecting courses that overlap with another GEC category, such as the Second Writing Course, Social Sciences, Arts and Humanities, and/or Historical Study. Otherwise additional credit hours may be added to the minimum required for the degree.

Revised 10-1-10

Curriculum map for the **B.A. and B.S. degrees in Chemistry**

Program outcomes *(B=beginning, I=intermediate, A=advanced)*

1. Students solve state-of-the-art chemistry problems, working both individually and in groups, and these problems will exemplify current disciplinary and interdisciplinary principles as well as modern pedagogical practice.
2. Students develop effective skills in oral and written communication of scientific knowledge.
3. Students plan experimental procedures, carry out chemical procedures, use laboratory equipment, analyze data and prepare laboratory reports that reinforce current chemical practices.
4. Students follow safe practices in the laboratory and demonstrate scientifically ethical practices.
5. Students retrieve information from the chemical literature, and become proficient in online database searching.
6. Students use modern computer software for graphing, manipulation of symbolic mathematical expressions, and quantum chemical calculations.

	Chemistry Program Goals					
Course	**1**	**2**	**3**	**4**	**5**	**6**
Chemistry 1210	B	B	B	B	B	B
Chemistry 1220	B	B	B	B	B	B
Chemistry 1610	I	I	I	B	I	I
Chemistry 1620	I	I	I	B	I	I
Chemistry 1910H	I	I	I	B	I	I
Chemistry 1920H	I	I	I	B	I	I
Chemistry 2210	I	I	I	I	I	I
Chemistry 2210H	I	I	I	I	I	I
Chemistry 2510	I	I	I		I	I
Chemistry 2520	I	I	I		I	I
Chemistry 2540	I	I	I	I	I	I
Chemistry 2540H	A	A	A	A	A	A
Chemistry 2550	I	I	I	I	I	I
Chemistry 2550H	A	A	A	A	A	A
Chemistry 2610	I	I	I		I	I
Chemistry 2620	I	I	I		I	I
Chemistry 2910H	A	A	A		A	A
Chemistry 2920H	A	A	A		A	A
Chemistry 3510	A	A	A		A	A
Chemistry 4200	A	A	A		A	A
Chemistry 4210	A	A	A		A	A
Chemistry 4300	A	A	A		A	A
Chemistry 4310	A	A	A		A	A
Chemistry 4410	A	A	A	A	A	A
Chemistry 4550	A	A	A	A	A	A
Chemistry 4870	A	A	A		A	A
Chemistry 4880	A	A	A	A	A	A
Biochemistry 4511	A	A	A		A	
Chemistry 5000 and above	A	A	A	A	A	A

Transition Policy for the Department of Chemistry

Students who begin their degree training under quarters will not be penalized as we transition to semesters. Our two chemistry advisors are available to help design the ideal program for each of our 400+ chemistry majors in order to facilitate an optimum transition.

In general, our current quarter courses are typically either a one-quarter class or a three-quarter sequence across an entire academic year. These courses will be converted to one-semester or two-semester courses, respectively. The few two-quarter course sequences have been converted to one-semester courses.

Also, our chemistry majors and minors are typically successful in completing an entire sequence of either general or organic chemistry in the autumn-winter-spring academic year. As was evident with the various quarter and semester plans provided with this package, most sequences would normally end in the spring term of any academic year.

In general and organic chemistry, we will continue our current practice of offering multiple courses in the summer term – for example, general chemistry (121–122–123) courses are offered in each of the four quarters. We anticipate continuing these trends for general chemistry and also continuing to offer some organic chemistry in the summer session. Moreover, in the normal academic year, we will offer general and organic chemistry courses in both semesters.

While we have created majors-only versions of general and organic chemistry, chemistry majors are eligible to take the Honors or the regular sequences instead of the majors-only version. Students who are off-sequence for whatever reason are not penalized in any way.

If space is available and enrollment demand is sufficiently evident, we plan on offering multiple sections of high enrollment courses in both semesters.

For advanced science electives, there will be multiple 5000-level and above courses for students to select. As our graduate program is sizeable, we will continue to offer graduate-level courses for our upper-level undergraduate students to select as electives.

There will be bridge or transition courses for general chemistry and organic chemistry for a short period of time, and these may be offered in alternate formats, including 7-week half-semesters. Students who have credit for Chemistry 121–122 under quarters will be very prepared for the second semester of general chemistry (1220). Similarly, students who have credit for Chemistry 251–252 will be prepared for the second semester (Chemistry 2520). Bridge or transition courses will be available for students who have not taken the middle quarter of a three-quarter sequence in order for those students to be successful in the second semester of the year-long sequence. However, these options for general chemistry courses will depend heavily on laboratory utilization as anticipated enrollment increases for the onset of semesters will require some assessment of priorities.