



Northampton Community College

Chemistry
Associate in Science Degree
Audit
2014 - 2019

External Auditor:

Dr. Ryan Fealy
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Bucks County Community College

Audit Prepared By:

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CHEMISTRY PROGRAM
Audit Report
2014-2019

PROGRAM PURPOSE

The Chemistry Associate in Science degree has been offered at the college since it opened, and it continues to prepare students to transfer to a four-year college or university by providing the equivalent of the first two years of a baccalaureate program in Chemistry. The program also serves to upgrade knowledge and skills of individuals in the workforce, who identify this need.

CURRICULUM (See Appendices A & B)

The Associate in Science degree for Chemistry consists of 61 total credits. There are two components to the curriculum for the Chemistry associate in Science degree: general education courses (27 credits), and program courses (34 credits). The program courses include the disciplines of chemistry, physics and math and consist of 8 courses totaling 34 credits. Program courses include:

Course Code	Course Title	Credits
First Semester		
CHEM 120	General Chemistry I	4
MATH 180	Calculus I	<u>4</u>
		8
Second Semester		
CHEM 220	General Chemistry II	4
MATH 181	Calculus II	4
PHYS 215	Physics for Science and Engineering I	<u>5</u>
		13
Third Semester		
CHEM 201G	Organic Chemistry I	4
PHYS 225	Physics for Science and Engineering II	<u>5</u>
		9
Fourth Semester		
CHEM 251	Organic Chemistry II	<u>4</u>
	4	
Total Credits from Program courses		34

Three required courses are included within the general education electives:

- English I – 3 credits
- English II – 3 credits
- Speech Communication – 3 credits

These courses are typically taken during the first two semesters of the program.

For the remaining 17 credits of General Education Electives, students must select one course from the list of approved courses in each of the following categories:

- Arts and Humanities (AH)
- Social Science: Societies and Institutions over Time (SIT)
- Social Science: Scientific Study of Human Behavior (SSHB)
- One course should be designated as Diversity (D)

Some of the approved courses may count for multiple categories.

A. Sanofi Pasteur Grant Spanning Academic Years 2018-2020

Sanofi Pasteur in Swiftwater, PA, has generously chosen to fund the Monroe Campus at NCC with a Grant totaling \$164,508. The monies from this grant have been used in part to spearhead a Strategic Planning Initiative headed by Co-PI's Beatriz Villar (Biological Sciences) and Danielle Ringhoff (Chemistry) to bring greater visibility to Undergraduate Research Experiences (URE) and encourage faculty and students to become involved in URE across both Bethlehem and Monroe campuses. The Strategic Plan and Goals include advancing and increasing URE at NCC, following the national CCURI model (Community College Undergraduate Research Initiative), to successfully implement and establish inquiry-based and high-impact teaching practices from introductory courses and across disciplines; and investigating the current state of UREs at NCC while addressing faculty strengths and research interests, barriers to implementation and opportunities for collaborations with four-year institutions and community organizations with research opportunities; developing URE models considering the characteristics of our institution, its faculty and students. The plan will determine a cost effective and appropriate approach, will address faculty strengths and research interests and barriers to implementation.

Information about URE opportunities will be made available to all faculty and students by creating a resource center with information availability through the Center for Teaching and Learning Technology (CTLT) website.

One barrier to implementation of URE identified by faculty was a lack of support in remuneration for the amount of actual time and effort required to mentor students completing a 1.0 credit (3 laboratory hour) research experience. The latest Faculty Contract for the years 2019-2022 has addressed this issue, removing this barrier.

Faculty have completed URE with students, and will continue in the future, in areas including use of two permanent research sites at Monroe Campus: An avian research site has been established at the Monroe Campus, and a Greenhouse is currently under construction on the Monroe Campus. Both of these areas lend themselves to cross-disciplinary work with the chemistry department and students.

4 Students have also been awarded Sanofi Grants of \$5,000 based upon financial need and merit within the STEM fields.

In determining the effectiveness of URE offerings at NCC, we have also outlined some short-term and long-term evaluation guideposts. For the short term, it would be important to assess both conceptual knowledge and development of skills in URE Students important to STEM professionals; consider a range of outcomes and the duration/timing of the URE, lending flexibility for both independent research

activities and classroom embedded models; examine the impact of UREs on different student populations (diversity); and to examine the impact on the faculty/mentor to understand how URE alters their sense of effectiveness and satisfaction. In the Long-term, it would be critical to know impacts on retention rates of students involved in UREs, to follow up with transfer institutions of students involved in UREs while at NCC, and to assess changes to the number and level of faculty/mentors involved in UREs.

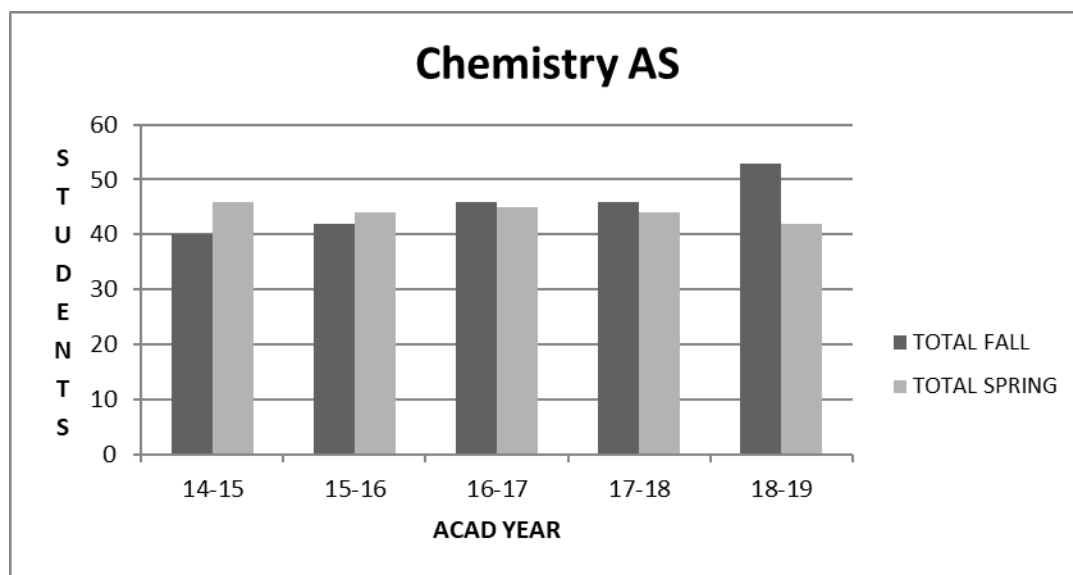
ASSESSMENT/ACADEMIC RIGOR (See Appendix C)

Assessment of Academic Rigor ensures there are at least four courses at 200 level for the degree. Assessment projects consist of in and out of classroom student assessments of content.

ENROLLMENT

Overall, the enrollment for this program has historically been low but has seen slight increase in overall heads and FTE's in the last two years of the cycle. **Total FTE's have decreased from an average of 30.23 for 2010-2014 to 28.89 for the current 2015-2020 audit cycle.** It should be noted that all biology majors must take the core chemistry courses. This includes General Chemistry I (Chem 120), General Chemistry II (Chem 220), Organic Chemistry I (Chem 201G), and Organic Chemistry II (Chem 251).

Chemistry AS CHMD	TOTAL ENROLLMENT	ACAD YR	14-15	15-16	16-17	17-18	18-19
FALL							
FULL-TIME			19	20	22	26	30
PART-TIME			21	22	24	20	23
TOTAL FALL			40	42	46	46	53
SPRING							
FULL-TIME			19	18	25	26	26
PART-TIME			27	26	20	18	16
TOTAL SPRING			46	44	45	44	42



PROGRAM COSTS (See Attachment D)

The number of FTE's and program credit hours has remained relatively constant over this audit cycle. Tuition income has consistently exceeded program costs in all of the five years in this cycle. The Income/FTE has increased based on salaries and cost of materials and equipment for laboratories.

FACULTY

There are two full-time faculty in the chemistry department at the Bethlehem campus, Associate Professor David Gelormo and Professor William Magilton and one full-time faculty at the Monroe campus, Dr. Danielle Ringhoff. William Magilton has been employed at the college for 10 years full-time and 15 years overall. David Gelormo has been employed at the college for 11 years. Dr. Ringhoff joined the faculty in 2011.

William Magilton's primary area of focus is on the General Chemistry courses taken primarily by chemistry and Biology majors. David Gelormo's focus is on Organic Chemistry for Chemistry and Biology majors as well as Chemistry of Life, a chemistry that combines aspects of General, Organic and Biochemistry for health field intent students. Dr. Ringhoff teaches both General Chemistry and the Organic Chemistry sequence.

The part-time adjunct faculty working in the chemistry department at both campuses are highly qualified and have worked for the college on a consistent basis. The full-time faculty make themselves available

to the adjuncts for course support, orientation, and questions. Courses taught by the adjunct faculty include: General Chemistry, Chemistry of Life, Organic Chemistry and non-majors chemistry.

NCC is fortunate to be able to employ professional lab technicians in chemistry to support the faculty and the student learning experience. Mr. Darryl Peters (BS in Chemistry from East Stroudsburg University) and works at the Bethlehem campus and Megan Warnkin (Associates Degree in Biology, Environmental Studies from Warren County Community College) supports the program at the Monroe campus. The Bethlehem campus also has three part time laboratory assistants, Keith Davis, (MS in Chemistry from Lehigh University), Robyn Davis, (MS in Biology from East Stroudsburg University), and April Todd-Gannon, (AS in Biology, Chemistry). There are also two part time lab assistants at the Monroe campus: Selena Jones (BS in Biology with minor in Chemistry from East Stroudsburg University) and Melissa Doll, (BS in Biotechnology from East Stroudsburg University). These lab technicians provide assistance to faculty through preparation and coordination of the instructional labs and facilitating communication with adjunct faculty regarding the labs and lab setups.

Program course section size is limited to 24 students for all program courses due to the lab component. At the Bethlehem campus, some sections of the lecture component are combined and this results in faculty: student ratios of 1:48 or 1:72. Consistently at both campuses the lab faculty: student ratios are consistently maintained at a maximum of 1:24.

2015 – 2020 Full-time

David Gelormo	Ph.D., Lehigh University
William Magilton	M.S., Lehigh University
Danielle Ringhoff	Ph.D., Lehigh University

2015 - 2020 Part-time

Al-Rashid, Ziyad	PhD, University of Minnesota,
Beautreau, Denise	MS, Long Island University
Bielski, Roman	PhD, Polish Academy of Sciences
Davis Keith	MS, Lehigh University
Dewhurst, John	PhD, University of New Hampshire
DiStasio, Anthony	MS, Wagner College
Fleming, Edward	PhD, Boston College
Follweiler, Douglas	PhD, University of Pennsylvania
Fromert, Gary	MS, East Stroudsburg University
Glover, Lisa	MS, Lehigh University
Haller, Tom	MS, University of Delaware
Hornbach, Peter	MS, West Chester University
Martin, John	MS, Northern Illinois University

Morgan, David	MS, Lehigh University
Patra, Guy	PhD, Paris V. Descartes
Prozonic, Judith	MS, Temple University
Raker, David	MS, University of Scranton
Turkos, Robert	PhD, Carnegie-Mellon University
Schreffler, Lisa	MS, East Stroudsburg University
Smith, Elizabeth	MS, Catholic University of America
Smith, Jason	MS, Wilkes University
Vedage, Gamini	PhD, Lehigh University

PROGRAM OUTCOMES

A. Transfers and Graduates

College data indicates that 16 students transferred to a four-year college within the audit cycle.

Anecdotally, the chemistry faculty indicate that significantly more students transfer to four-year schools than the data reflect; some transfer before they complete their second year at NCC or before completing the AS degree requirements in Chemistry. College data also indicate that six students who graduated with the AS degree in Chemistry are now employed in the field of chemistry.

Chemistry Degree	Aug. '13	Aug. '14	Aug. '15	Aug. '16	Aug. '17	Aug. '18
	Dec. '13	Dec. '14	Dec. '15	Dec. '16	Dec. '17	Dec. '18
	May '14	May '15	May '16	May '17	May '18	May '19
# of Graduates	5	8	6	2	6	
employed	2	2	2	0	0	
job hunting	0	0	0	1	0	
continuing ed.	3	2	4	1	6	
other	0	4	0	0	0	
Employed Graduates	2	2	2	0	0	
Additional Data Not Avail.	—	—	—	—	—	—
related	1	2	0	0	0	
unrelated	1	0	1	0	0	
unrelated by choice	0	0	1	0	0	
Median starting salary (if >2 reported)	—	—	—	—	—	—

B. Current Student Satisfaction

The course evaluations for the chemistry courses reflect high level of student satisfaction among the students for the most part. The full-time faculty are rated at or above the college mean in most categories. This is commendable in a rigorous discipline like chemistry that tends to challenge the brightest of students. Students express that faculty are available and willing to help and genuinely interested in their success.

FACILITIES

A. Chemical Hygiene Plan (See Attachment)

In 2018 Professor Magilton and Dr. Ringhoff created a Chemical Hygiene Plan for the chemistry laboratories. This plan follows the OSHA guidelines for the laboratory standard. The Chemical Hygiene Plan is a written program stating the policies, procedures, and responsibilities that protect faculty, staff and students from the health hazards associated with hazardous chemicals used in the chemistry laboratories. All full time and part time faculty are required to undergo safety training every three years. A blackboard distance course was created to facilitate safety training.

B. Chemistry Labs

The chemistry labs on the Main campus were renovated 3-4 years ago to bring them into the 21st century. The labs at the Monroe campus greatly enhanced that campus's ability to offer a full complement of chemistry courses. As the instrumentation associated with the program ages, replacement equipment is requested as part of the capital budget process. Both the HPLC, GC-MS and H-NMR were replaced in the last five years.

C. Science Resource Center

There has been one major renovation during the cycle. In 2016, the Science Resource Center opened on the second floor of Penn Hall. This was the brainchild of Vice President Carolyn Bortz. The center provides duplicate models, slides, and specimens from all biology courses as well as providing free walk in tutoring. The center is open six days a week. Since its inception, data has shown a strong increase in success of students who have used the resource. It is a model-tutoring center.

Bethlehem SRC			Monroe Learning Center		
Semester	BIOS students	CHEM students	Semester	BIOS students	CHEM students
Fall 2015	362	206			
Spring 2016	341	166			
Fall 2016	378	191			
Spring 2017	296	231			
Fall 2017	306	191			

Spring 2018	327	154				
Fall 2018	387	207				
Spring 2019	361	162				
Fall 2019	472	215		Fall 2019	157	54



EXTERNAL AUDITOR REPORT

Bucks County Community College Science, Engineering & Mathematics Department

Northampton County Community College Chemistry Department Audit

Prepared by:

Dr. Ryan Fealy
Chemistry Coordinator
Associate Professor of Chemistry
Bucks County Community College
275 Swamp Road
Newtown, Pa 18940

Introduction

Northampton County Community College (NCCC) has a challenging task, which is to meet the diverse educational needs of the county. The population consists of a wide range of ability levels and career interests. The challenge is to meet that criteria while having most classes taught remotely through an online platform such as Blackboard Collaborate. I imagine that some faculty maybe using ZOOM or other related programs. It was nice to meet with students, faculty, and administration on October 1, 2020. Despite the challenge of connecting remotely, it was crystal clear to me that NCCC is ready to meet the challenge to offer a top-quality Chemistry Associates Granting Program, even in these trying times. The college has met this goal with modern technology, lab equipment, competitive instrumentation, and the hiring of qualified dedicated faculty. I will share my observations from the discussions I had along with the documents I was provided to complete this audit.

Facilities

The college is located just east of the city of Bethlehem, and west of Easton in the Lehigh Valley. In addition, a second satellite campus is located up north in Tannersville, Monroe County. I did miss the nice drive up to campus like I had with my last visit. Through email and ZOOM, everyone greeted my and made me feel very welcome. I saw that students, faculty, staff, and administration all appeared to love the college and found it to be like their second home. When I spoke to the student, Tyler, he mentioned to me how he interacted with both peers and faculty regularly when both on and off campus. He told me of the nice facilities where students could work on assignments and seek their professor's for help when he was on campus last spring. He also mentioned how he felt connected to a learning community even when everything had to go remote. It was clear by talking with both faculty and staff that the college had resources, such as an advanced form of Blackboard, to maintain good contact off campus. The community seemed still connected despite being remote.

I remember a few years back when I visited the campus, the classrooms used by the chemistry department consisted of spacious lecture halls equipped with overhead projectors, marker boards, comfortable seating, and tables adequate for note-taking. This set-up can allow for the use of power-point to aid with the traditional classroom instruction of writing on the marker boards. The lecture halls

were just the right size to hold a large number of students, and allow for each of them to hear and communicate clearly with their instructor during class. I know I did not visit the rooms this time around, but wanted to be clear that I have seen them.

In my last visit, I recall all of the laboratories are small, but very neat and tidy. They are well lit, and no matter where a student or instructor would sit they could see a very brightly-colored Periodic Table. The space could easily fit in 24 students plus one instructor, which is within the normal safety standards. Safety glasses and lab coats were hanging up in the corner of the room in case students wanted to use them. I passed through two laboratories in progress, and it seemed that in both cases the students were engaged in the lab. The instructor was also engaged, and set a good example by dressing with the proper lab attire.

During our conversation this time around, I spoke with Darryl Peters, Lab supervisor. He was speaking to me about the latest up to date equipment he has purchased. What was new and exciting to me were the latest Vernier equipment that students could use to carry out data acquisition type experiments with the aid of a lap top computer. What caught my eye were the Vernier air GC's (Gas Chromatographs). These are essential mini-instruments. The focus was delivering a top-notch program to prepare students to move on to a four-year program or perhaps even enter the workforce as a chemical technician. In addition to the new Vernier equipment, Darryl reminded me of their current list of instrumentation including a Fourier-Transform Infrared Spectroscopy (FTIR), Ultra Violet-Visible Spectroscopy (UV-VIS), Gas Chromatography coupled with Mass Spectroscopy (GC-MS), Atomic/Absorption Emission Spectroscopy (AAES), and nuclear magnetic resonance (NMR) capabilities. Since my last visit, I saw that the college was awarded the Sanofi Pasteur Grant (2018-2020) from Swiftwater, PA. Prof. Danielle Ringhoff was a co-PI along with Prof. Beatriz Villar. The grant focused on Undergraduate Research Experiences (UREs) that can help students further develop critical thinking and additional lab skills beyond the traditional classroom. From my perspective it seems that faculty dedication along with this grant has helped develop a strong consistency between the two campuses. I feel that this has made NCCC even better than before when we held the last audit. All of these skills acquired in the classroom, and laboratory will prepare students with a strong foundation that will allow employers and professional schools strongly desire them. Professors. Magilton and Gelormo both told me about their strong association with the Lehigh Valley Branch of the American Chemical Society (ACS). Along with URE's, NCCC students may get the opportunity to present results either virtually or face to face at a conference, which is more great experience that sets NCCC ahead of most schools.

Another discussion that we had was the plan to start bringing students onto campus for some limited labs for all levels of chemistry. I believe we spoke about Chemistry II and both Organic Classes for spring 2021. Darryl informed me of a detailed procedure to bring students onto campus to acquire the desired skills safely in small groups while social distancing. It was clear that both the college, faculty, and staff have everyone's safety as their highest concern. I was involved with similar planning being a department head at Bucks County Community College. What was clear was the desire to meet the objective for students to get those necessary skills so they can enter a very competitive future to pass with flying colors.

Support

I corresponded with Barbara Pechacek, Administrative Assistant, through email to schedule my meetings and to receive my audit paperwork. I also spoke with Dean Judy Rex after I met with the faculty and student Tyler. From our conversations it seems that the administration supports the department with their mission to maintain a very effective 2-year chemistry program.

Curriculum

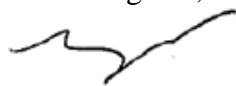
Other than URE development, the chemistry curriculum has stayed constant since my last visit. I will review the highlights. The major focus of the program serves two different audiences: science majors and allied health majors. I spoke with Dr. David Gelormo concerning the Chemistry of Life course. This is probably the course with the most diverse audience with many ability levels. I learned that there were on-site (in classroom) and online options for students to elect for the semester. I was very impressed with how he was dedicated to his students. He mentioned that he meets his students frequently during times outside of class to help them with course material. The math seems to be the biggest struggle for most students as expected. I was very impressed with the online course. He has been using Blackboard to communicate regularly with students while remote and online. We spoke specifically about the other course he teaches, the two-semester sophomore Organic course. He mentioned to me the challenges of teaching this high-level course remotely. He mentioned that students are struggling more so than usual due to being remote. I was impressed at what he has done to reach out to his students by email, discussion board, and virtual office hours. Prof. Bill Magilton has taken a similar approach in his General Chemistry courses. It seems that they have been using a series of online homework platforms, lecture videos, and question and answer sessions to coach the students through. Tyler, spoke very highly of all of the chemistry faculty and felt very comfortable asking them for help whether it be face to face, or in our current world remotely. He considered all of them his mentors, and wanted to emulate them. He is very happy to serve as a chemistry tutor and may consider teaching. Both FT faculty are centered around student success, and keep working hard to strive to reach out to a diverse audience.

Faculty

The faculty in the chemistry department at Bethlehem consists of two full time professors: Prof. William Magilton M.S., and David Gelormo, Ph. D. By reading my audit materials, I saw that the college has numerous experienced adjuncts holding either Ph.D.'s or Master's degrees. Both Magilton and Gelormo spoke highly of the adjunct faculty, and mentioned how much they too dedicate their time to student excellence. I did not get a chance to meet with Dr. Danielle Ringhoff, who teaches at the Monroe Campus. I was informed at how well she was doing at that campus trying to deliver a quality experience as it is offered at the main campus. Seems to me that all of the chemistry faculty make a solid team that works together for the best of NCCC students. Most faculty, full or part time, have their advanced degrees from Lehigh University a very well-respected institution world-wide. I feel that the faculty have the experience in both industry and academia to offer relevant lectures that apply abstract concepts to tangible real-world applications whether in the classroom (face to face or virtual) or performing URE's.

The faculty make the program, and both have done some very impressive work. Their dedication to the students is what makes the program. I approve of everything the department is doing to keep their chemistry program up to date. Please contact me if you have any further questions at 215-968-8354. Excellent facilities, faculty, and administration. It was a pleasure to evaluate NCCC again during this audit cycle. I do not have any major recommendations for change this time. I do feel that the Chemistry Associates is a small strong program that will prepare quality students well for their future goals.

Warm Regards,



Ryan J. Fealy Ph. D.

Chemistry Coordinator

Associate Professor of Chemistry Bucks County Community College

CONCLUSIONS & RECOMMENDATIONS

Areas of Strength The program has three strong full time faculty members (2 at Bethlehem, 1 Monroe). There is a chemical hygiene officer assigned at each campus for safety. There are strong lab assistants (2 at Bethlehem, 1 Monroe). The courses and program are up to date with industry standards.

Areas of Concern The fact that we had to convert all our courses to remote during the pandemic was a concern as it eliminated the onground laboratory components for late spring and fall 2020. For spring 2021, we plan on moving the labs with students social distanced and wearing masks on ground to enhance the experiential components.

Recommendations

My recommendation is to continue the program, grow enrollment, investigate the diversity, equity and inclusion in each course and program within 3 years and enhance the Chemistry research components and capabilities at each campus.

DocuSigned by:

William Magilton

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William Magilton
Professor

Judith Rex PhD, RN/BC

Judith Rex, PhD, RN, BC
Dean, Allied Health & Science Division

Chemistry

Allied Health & Sciences

Degree awarded Associate in Science

Program Narrative

If you are interested in pursuing a bachelor's degree in chemistry or a career in the areas of medicine or scientific research, Northampton's Chemistry program is an affordable way to start. With a curriculum, that parallels the first two years of most four-year programs, NCC can save you thousands of dollars on your undergraduate degree. By working closely with an advisor, you can choose the right electives, and stay on track with the requirements of the transfer college of your choice.

Another option some graduates have chosen is to enter the job market upon completion of their two-year Chemistry degree. NCC's program prepares you for the range of fields that are based in chemistry, including environmental sciences, manufacturing, biotechnology and more. Employment of chemical technicians is projected to grow 2 percent from 2018 to 2028, slower than the average for all occupations. Graduates of applied science technology programs who are trained to use equipment typically found in laboratories or production facilities should have the best opportunities.

State & Area Data

Program Features

Northampton has dual admissions agreements with a variety of colleges. These arrangements enable you to have admission to Northampton and the four-year institution you select. You will receive close advising, and, based on your performance, our agreements guarantee you easy transfer of credits. Courses in this program are offered primarily during the day.

Program Requirements

While there are no special admissions requirements for the Chemistry program, certain courses in the program require a background in English, algebra, and chemistry. If you are lacking background in these areas, you should acquire it during the summer preceding your first semester. Northampton's admissions and counseling staff can answer any questions or concerns you may have regarding your enrollment into this program.

Contact the Admissions Office at 610-861-5500 for further information.

Program Outcomes

Graduates of the program will:

- Demonstrate the ability to solve problems and explain chemical processes.
- Apply scientific principles and skills in conducting experiments, and in the use of instrumentation and analysis of results.
- Present research in acceptable written and oral format using scientific literature and computer aided analysis
- Demonstrate the ability to work successfully in independent and collaborative settings.
- Demonstrate best practice of safety and laboratory techniques and procedures.

Chemistry

Associate in Science Degree

Course Code	Course Title	Credits
First Semester		
COLS 101	College Success	1
CHEM 120	General Chemistry I*	4
CMTH 102	Introduction to Communication	3
ENGL 101C	English 1	3
MATH 180	Calculus I**	4
		15
Second Semester		
CHEM 220	General Chemistry II	4
ENGL 151L	English II (Literature)	3
MATH 181	Calculus II	4
-----	General Education Elective	3
		14
Third Semester		
CHEM 201G	Organic Chemistry I	4
PHYS 215	Physics for Science and Engineering I	5
-----	General Education Elective	3
-----	General Education Elective	3
		15
Fourth Semester		
CHEM 251	Organic Chemistry II	4
PHYS 225	Physics for Science and Engineering II	5
-----	Electives	8
		17
	Total Credits:	61

* Students that are not CHEM 120 ready for their first semester should take CHEM 011 first.

** Students that are not MATH 180 ready for the first semester should take MATH 160 or 140 first. It is highly recommended that all students start their math sequence in the first semester

- For the General Education Electives, students must select one course from the list of approved courses in each of the following categories: Arts and Humanities (AH); Social Science: Societies and Institutions over Time (SIT) and Social Science: Scientific Study of Human Behavior (SSHB).
- One course should be designated as Diversity and Global Awareness (D).
- Completion of CHEM 201G satisfies the program-related Writing Intensive (WI) requirement. In addition, one General Education Elective must be taken in a Writing Intensive (WI) section.
- Computer competencies are included in various program courses, specifically CHEM 120, 220, 210G, and 251. Thus, completing the program automatically satisfies the computing requirement for this program.

NCC students have transferred to: Cedar Crest College, East Stroudsburg University, Kutztown University, Lafayette College, Lehigh University, Lock Haven University, Penn State University, University of Hawaii

The A.S. in CHEMISTRY prepares you for these other areas of study: Medical School, Biotechnology, and a multitude of chemistry related industries.

Course Descriptions

CHEM 011 Chemical Calculations (Cr2) (2:0)

This course is designed to meet the needs of Allied Health, science and engineering students to prepare them for CHEM135 (Chemistry of Life) or CHEM 120 (General Chemistry I), required courses in their programs of study. The development of skills for solving quantitative (numerical) problems is emphasized. Topics include measurement, basic chemical concepts and theories, and nomenclature of simple ionic and covalent compounds.

CHEM 105 Chemistry in Contemporary Society (Cr4) (3:2)

This lecture and laboratory course is designed for non-science majors. Students will learn about the many discoveries in chemistry and how they have resulted in significant changes in our world and in the quality of our lives. Students will become better informed about our chemical world in areas such as nutrition, consumer products, medicine, agriculture, industrial products, air and water pollution, and energy. Approved for the Honors Program. Core: SCI.

CHEM 120 General Chemistry I (Cr4) (3:3)

Chemistry I is a qualitative and quantitative study, both in the classroom and the laboratory, of matter and energy as they relate to the chemical properties of solids, liquids, gases, and solutions. Topics include stoichiometry, atomic/ molecular structure, bonding, states of matter, changes of state, and solutions. A quantitative study of each area is stressed; a strong background in chemistry and mathematics is required. This course is intended for science and engineering majors. Prereq. - Appropriate competence as outlined in the Mathematics Placement policy or MATH022; Chemistry (1 year of high school chemistry or CHEM011); and Reading and writing competence as determined for ENGL101. Core: SCI.

CHEM 121 Lab Safety Procedure (Cr2) (2:0)

Development of safety attitudes and safety training, toxicological concepts, hazards, risk analysis, chemical storage and disposal, safety regulations, and safety literature, examination of selected case studies and accidents.

CHEM 135 Chemistry of Life (Cr4) (3:2)

Principles of general, organic, and biochemistry with emphasis on applications in the health sciences. Also available through Online Learning. Core: SCI.

CHEM 201G Organic Chemistry I (Cr4) (3:3)

Functional groups, structures, stereo-chemistry, rates of reactions, reaction mechanisms, preparations and reactions of alkanes, alkenes, dienes, optical isomers, and aromatic compounds; modern organic lab techniques and applications to chemistry, biology, and chemical engineering. Pre- or coreq. - CHEM 220 and Prereq. ENGL 101.

CHEM 220 General Chemistry II (Cr4) (3:3)

This lecture and laboratory course is a continuation of CHEM 120, General Chemistry I. Students will learn molecular shapes, chemical reactions, changes of state and properties of liquids, solutions, reaction kinetics, chemical equilibrium, thermodynamics and electrochemistry. Equilibrium topics include gaseous reactions, the ionization of weak acids and bases, hydrolysis of salts, and buffers. Prereq. - CHEM 120.

CHEM 225 Quantitative Analysis (Cr4) (3:3)

Evaluation of analytical data, aqueous and nonaqueous solution chemistry, titration curves, electrochemistry; theory and applications of: gravimetric, titrimetric, potentiometric, complexation, electroanalytical, spectrophotometric, and chromatographic methods of analysis. Prereq. - CHEM 220.

CHEM 228 Chemical Methods and Instrumentation (Cr3) (2:3)

Instrumentation including GC, HPLC, GC/MS, IR, NMR, ICP; introduction to EPA, TQM, and ISO-9000; regulatory compliances; team-oriented problem solving/process improvement methods. Prereq. - CHEM 220.

CHEM 251 Organic Chemistry II (Cr4) (3:3)

Continuation of CHEM 201, including preparation and reactions of alcohols, thiols, disulfides, ethers, aldehydes, ketones, carboxylic acids, amides, esters, amines, amino acids, and proteins; modern organic lab techniques, and an optional student project in lab. Prereq. - CHEM 201.

CHEM260 Biochemistry (Cr3) (3:0)

In this course, emphasis will be placed on the chemistry of biomolecules and their utilization in intermediary metabolism. The principles of bioenergetics and the integration of metabolic control are developed. This course is lecture-only and is intended for students majoring in chemistry, biology, or who intend on pursuing a career in medicine, dentistry, pharmacy or other health-related field. Pre- or co-req. - CHEM251

CHEM 261 Research in Chemistry (Cr1) (0:3)

This course provides students with an opportunity to do supervised undergraduate research of a topic of interest. Students will utilize the principles, laws, and theories of general chemistry to successfully analyze samples provided using selected instrumental methods. The student will need to be competent to follow a standard procedure, to operate the instrument in a safe manner, to collect suitable data, to evaluate the reliability of the data collected, and to report the results in an appropriate form as would be required of a competent laboratory technician. Repeatable; may be taken 2 times. Prereq. - CHEM 220 and permission of the instructor.

CHEM 291 Special Studies in Chemistry (Cr1)

See Statement on Special Studies. Offered on demand.

CHEM 292 Special Studies in Chemistry (Cr2)

See Statement on Special Studies. Offered on demand.

CHEM 293 Special Studies in Chemistry (Cr3)

See Statement on Special Studies. Offered on demand.

CHEM 294 Special Studies in Chemistry (Cr4)

See Statement on Special Studies. Offered on demand.

Program Name: Chemistry, AS

Mapping Completion

Date: November 3,

2017

Effective Date: FALL

2018

Pre-Degree Requirements (if any):

Program Specific: None
 Reading and Writing: None
 Placement:
 Mathematics Placement: None

SEMESTER-BY-SEMESTER PROGRAM PLAN FOR FULL-TIME STUDENTS

Plans can be modified to fit the needs of part-time students by adding more semesters

SEMESTER 1							
Course # (listed in preferred order of completion)	Course Title (course title as listed in college catalog)	Credits (credits earned for completion of course)	Degree(s) (degrees where course fulfills a requirement)	Course Type (core/required for program or elective & type)	Gen Ed Requirement (if applicable)	Term/Location Offered (F, W, SP, SU) (Beth, Monroe, Fowler, Online)	Pre-requisites/Co-requisites
COLS101	College Success	1	AS	FYE			
CHEM 120	General Chemistry I	4	AS	Required		F, SP, SU; Beth, Mon	ENGL / MATH Placement Policy
CMTH 102	Speech Communication	3	AS	Gen Ed	Communication	F, SP, SU; Beth, Mon On	
ENGL 101	English I	3	AS	Gen Ed	Communication	F, SP, SU; Beth, Mon On	ENGL Placement Policy
MATH 180	Calculus I	4	AS	Gen Ed	QL	F, SP, SU; Beth, Mon On	MATH Placement Policy
Total Semester Credits:		15					
SEMESTER 2							
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
CHEM 220	General Chemistry II	4	AS	Required		F, SP, SU; Beth, Mon	CHEM 120
ENGL 151L	English II	3	AS	Gen Ed	Communication	F, SP, SU; Beth, Mon On	ENGL I

MATH 181	Calculus II	4	AS	Required		F, SP, SU; Beth, Mon	MATH 180
	General Education Elective (AH, SIT, SSHB)	3	AS	Gen Ed	AH, SIT, SSHB	F, SP, SU; Beth, Mon On	
Total Semester Credits		14					
				Semester 3			
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
CHEM 201G	Organic Chemistry I	4	AS	Required; WI		F, SP, SU; Beth, Mon	CHEM 220
PHYS 215	Physics for Science and Engineering I	5	AS	Required		F, SP; Beth, Mon	MATH 181
	General Education Elective (AH, SIT, SSHB)	3	AS	Gen Ed	AH, SIT, SSHB	F, SP, SU; Beth, Mon On	
	General Education Elective (AH, SIT, SSHB)	3	AS	Gen Ed	AH, SIT, SSHB	F, SP, SU; Beth, Mon On	
Total Semester Credits		15					

				Semester 4			
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
CHEM 251	Organic Chemistry II	4	AS	Required		F, SP, SU; Beth, Mon	CHEM 201G
PHYS 225	Physics for Science and Engineering II	5	AS	Required		F, SP; Beth, Mon	MATH 181
	Electives	8	AS	Elective		F, SP, SU; Beth, Mon On	
Total Semester Credits:		17					
Total Degree Credits:		61					

Notes:

- Students that are not CHEM 120 ready for their first semester should take CHEM 011 in its place.
- Students that are not MATH 180 ready for their first semester should take MATH 160 in its place. If the student is not MATH 160 ready they should take MATH 140. It is highly recommended that all students start their math sequence in the first semester.
- For the General Education Electives, students must select one course from the list of approved courses in each of the following categories: Arts and Humanities (AH); Social Science: Societies and Institutions over Time (SIT) and Social Science: Scientific Study of Human Behavior (SSHB).
- One course should be designated as Diversity (D).
- Completion of CHEM 201G satisfies the program-related Writing Intensive (WI) requirement.
- Computer competencies are included in various program courses, specifically CHEM 120, 220, 210G, and 251. Thus, completing the program automatically satisfies the computing requirement for this program.

Program Narrative:

If you are interested in pursuing a bachelor's degree in chemistry or a career in the areas of medicine or scientific research, Northampton's Chemistry program is an affordable way to start. With a curriculum that parallels the first two years of most four-year programs, NCC can save you thousands of dollars on your undergraduate degree. By working closely with an advisor, you can choose the right electives, and stay on track with the requirements of the transfer college of your choice. Another option some graduates have chosen is to enter the job market upon completion of their two-year Chemistry degree. NCC's program prepares you for the range of fields that are based in chemistry, including environmental sciences, manufacturing, biotechnology and more.

Program Learning Outcomes:

- Demonstrate the ability to solve problems and explain chemical processes.
- Apply scientific principles and skills in conducting experiments, and in the use of instrumentation and analysis of results.
- Present research in acceptable written and oral format using scientific literature and computer aided analysis
- Demonstrate the ability to work successfully in independent and collaborative settings.
- Demonstrate best practice of safety and laboratory techniques and procedures.

Program Requirements:

While there are no special admissions requirements for the Chemistry program, certain courses in the program require a background in English, algebra, and chemistry. If you are lacking background in these areas, you should acquire it during the summer preceding your first semester. Northampton's admissions and counseling staff can answer any questions or concerns you may have regarding your enrollment into this program.

Transfer Information:

NCC students have transferred to: Cedar Crest College, East Stroudsburg University, Kutztown University, Lafayette College, Lehigh University, Lock Haven University, Penn State University, University of Hawaii

Career Information:

The A.S. in CHEMISTRY prepares you for these other areas of study: Medical School, Biotechnology, and a multitude of chemistry related industries.

[CLICK HERE TO SELECT A DATE]

PROGRAM RIGOR ANALYSIS

Name of Program: CHEMISTRY

Type of Program (AA, AS, or AAS): **ASSOCIATE IN SCIENCE**

Total number of credits: **60**

The table below lists elements of analysis in reviewing academic rigor in the program. The elements will include a review of program learning outcomes, program sequencing, the curriculum arrangement, and transferability (for AA and AS degrees.) Discuss each element and record faculty feedback/consensus in the evidence column. Confirm whether acceptable or not and complete the Action Plan column where changes are deemed necessary.

Faculty involved in the analysis (Enter faculty names): Danielle N. Ringhoff, et al.

LIST THE PROGRAM LEARNING OUTCOMES:

1. Demonstrate the ability to solve problems and explain chemical processes.
2. Apply scientific principles and skills in conducting experiments, and in the use of instrumentation and analysis of results.
3. Present research in acceptable written and oral format using scientific literature and computer aided analysis
4. Demonstrate the ability to work successfully in independent and collaborative settings.
5. Demonstrate best practice of safety and laboratory techniques and procedures.
6. Demonstrate and understand the scientific method, interpretation of scientific data, and scientific literature.
7. Be prepared to pursue a career at the Associates Level, prepared to transfer to a 4-year bachelor's program. Or other pre-professional programs.

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
<p><u>Review of Program Learning Outcomes</u></p> <p>Do program Learning Outcomes reflect level of knowledge, skills, & competencies for an Associate degree? Do the Learning Outcomes describe the characteristics of graduates from the program? Record evidence of faculty discussions/analysis in the "Evidence" column to the right.</p>	<p>The program learning outcomes reflect the level of knowledge and skills for an Associate degree in Chemistry. The characteristics of an Associate degree in Chemistry commensurate with those of a Baccalaureate degree in Chemistry. Students with an Associate degree are capable of doing junior level research. Our students have presented their research posters at many American Chemical Society meetings. Their work has been well received by faculty and peers of many of the local colleges and universities.</p>	<input type="checkbox"/>	<input type="checkbox"/>	
<p>Do program Learning Outcomes reflect appropriate growth according to Bloom's taxonomy (move students toward higher level</p>	<p>Outcome 1: Experiments, homework problems, exams, and essay questions are designed to focus on student understanding and application of fundamental concepts and practices within chemistry through explaining concepts, predicting reaction outcomes, calculating quantities of chemicals, solving</p>	<input type="checkbox"/>	<input type="checkbox"/>	

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
<p>thinking and problem solving)?</p> <p><i>(See Bloom's taxonomy and verbs and additional resources on the final pages of this document)</i></p> <p>Record evidence of faculty discussions/analysis in the "Evidence" column to the right.</p>	<p>complex problems, and graphing data in order to interpret outcomes.</p> <p>Exhibit: example of lecture presentation with in-class problem solving as a demonstration of expectations.</p> <p>Outcome 2: Students are provided laboratory manuals that detail experimental processes that are meant to stress understanding of topics, application of theoretical concepts in a hands-on environment, analysis and evaluation of results obtained, and creation of reports. Through this, students hypothesize experimental outcomes, develop plans for performing laboratory experiments, select appropriate literature reference materials in support of the work, compare results to reported literature values, and explain strengths and weaknesses of their data.</p> <p>Exhibit: Example of lab notebook experimental records</p> <p>Exhibit: Laboratory manual experiment used for guidance in lab notebook organization.</p> <p>Exhibit: Grading Rubric for lab notebook records.</p> <p>Outcome 3: Students are required to demonstrate understanding of laboratory endeavors by writing up</p>			

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
	<p>their experimental results in the form of a formal laboratory report. Reports require remembering concepts in identification of reaction mechanisms, restating hypotheses, and identifying scientifically relevant data-driven conclusions. Experiments are designed to require the usage of numerous types of instrumentation, most all of which are computer-interfaced. Chemical structures and equations are required to be created using computer-based free software, such as Marvin Sketch or other web-based applications.</p> <p>Exhibit: Student formal lab report.</p> <p>Exhibit: Grading Rubric for lab reports.</p> <p>Outcome 4: Collaboration amongst students is encouraged through teamwork in the laboratory setting. Students work in groups of 2-3 to accomplish tasks towards the end goal of completing an experiment in a timely fashion. Students must evaluate their goals to determine the most efficient and creative ways to finish the task at hand. This involves appraisal of the steps to perform an experiment, determining what can be accomplished simultaneously through division of labor, explaining to</p>			

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
	<p>each other what they have done independently towards reaching that goal, and sharing any data recorded independently. For example, one student might construct a glassware apparatus for an experiment while the partner obtains all the necessary reagents in the prescribed quantities. Laboratory and lecture problems are also given as a guide to students in how they will need to approach their experimental data when analyzing and evaluating results.</p> <p>Exhibit: Pre-laboratory questions for a given experiment.</p> <p>Outcome 5: Laboratory safety is stressed throughout all courses. Students must read, understand, and sign a laboratory safety agreement at the beginning of the semester for each laboratory course in which they enroll. Proper techniques for handling various chemicals is demonstrated, Safety Data Sheets (SDS) are made immediately available to students in binders and in CD format, and safe handling chemicals, the necessary personal protective equipment, and proper disposal techniques are stressed before each laboratory session commences.</p>			

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
	<p>Exhibit: Pre-laboratory briefing with relevant information about experiments and final slide of safety precautions stressed.</p> <p>Outcome 6: Data is collected and analyzed for all courses that include a laboratory component within the major. Students must demonstrate understanding of the scientific method through their preparations for laboratory experiments and in applying scientific methodology to practice exercises in a classroom setting.</p> <p>Exhibit: Problems requiring organized, step-wise evaluation of processes</p> <p>Outcome 7: The academic program for the A.S. in Chemistry is constructed in a sequential progression so that students can continuously build upon their skills through their studies. Completion of the requisite sequence prepares students for transfer to 4-year bachelor's programs within chemistry and other related fields of study. Students meet with advisors to evaluate their progress and create a plan for elective course selections based upon their</p>			

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
	potential careers. Numerous articulations agreements are in place with a variety of 4-year schools. Exhibit: Program sequence from the course catalog.			
Does the course sequence supports student acquisition of and development of disciplinary and/or career knowledge. Record evidence of faculty discussions/analysis in the "Evidence" column to the right.	Yes. Students obtain a broad foundation of all subdivisions within chemistry through the General Chemistry 1 & 2 sequence. Students are then exposed to upper level coursework that builds upon the foundations with ancillary supporting courses in the disciplines of math and physics.	<input type="checkbox"/>	<input type="checkbox"/>	
Are the program courses arranged to support measurable progression in learning/critical thinking/problem-solving?	Yes. For example, students learn about balancing chemical equations, determining percent yields when given a specific quantity of reactants, and properly making solutions in CHEM120 and 220. Those skills are necessary and used to further evaluate organic syntheses in upper level coursework.	<input type="checkbox"/>	<input type="checkbox"/>	
Does the course sequence include appropriate pre-	Yes. Students are required to take General Chemistry 1 before General Chemistry 2 or Organic Chemistry 1.	<input type="checkbox"/>	<input type="checkbox"/>	

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
<p>requisite courses to support learning/critical thinking/ problem-solving?</p> <p>Record evidence of faculty discussions/analysis in the "Evidence" column to the right.</p>	<p>Students must take Organic Chemistry 1 before Organic Chemistry 2.</p> <p>Currently there is a prerequisite for students to have complete MATH022 (Elementary Algebra) prior to enrolling in CHEM120, to have shown competency in English by concurrently being enrolled in or having completed ENGL101, and having a foundation in chemistry through either high school chemistry or completion of CHEM011 (Preparatory Chemistry).</p>			
<p>Are there a sufficient number of 200-level courses required?</p> <p>ENTER THE NUMBER IN THE DEGREE HERE: ___5___</p> <p>MINIMUM OF 4 REQUIRED IN THE DEGREE PROGRAM (These 4 required 200 level courses can include general education, electives or program courses)</p>	<p>5 courses are required at the 200-level. Additional 200-level courses may be taken by students as electives as well.</p> <p>CHEM220 – General Chemistry 2 CHEM201G – Writing Intensive Organic Chemistry 1 CHEM251 – Organic Chemistry 2 PHYS215 – Physics for Science and Engineering 1 PHYS225 – Physics for Science and Engineering 2</p>	☒	☐	

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
<p>If < 4, are there required courses in the degree that are 100-level that have 200-level rigor. If yes, list courses here:</p> <p><i>If renumbering a course is being considered, a Course Rigor Analysis worksheet is available to document this assessment. Please consult your dean for that worksheet.</i></p> <p>For programs not meeting the minimum requirement, please note in the evidence column how you will meet that requirement. (Justify current rigor or note recommendations for change.)</p>				

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
<p><u>Review of Transferability</u> <u>(Complete this section for programs designed for transfer AA/AS/some AAS)</u></p> <p>Can graduates of the program transfer easily?</p> <p>List top transfer institutions for your program.</p> <p>Are their articulation/transfer agreements for this program? Include a list of or links to these agreements.</p> <p>List top transfer institutions for the degree here:</p> <p>Data source:</p>	<p>Transferability is built into the curriculum. Articulation agreements are already in existence with Pennsylvania State Schools.</p> <p>http://www.pacollege-transfer.com/Search/SearchforTransferAgreements/TransferAgreementSearchResults/tabid/243/Default.aspx?fschool=214379&tschool=&keyword=Chemistry</p> <p>List of Articulation Agreements: http://catalog.northampton.edu/transferring/list-of-agreements.htm</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<p>Do courses in the major transfer count toward the</p>	<p>Yes</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
four-year degree program?				
<p><u>Review of Career Readiness – Preparation for Employability</u> <u>(Complete this section for programs designed to prepare graduates for direct employability - AAS)</u></p> <p>Are program learning outcomes aligned with employer/business/industry/ accreditation agency expectations? If yes: how is this verified? If no, complete action plan/responsibility column. Placement data indicates employability (Refer to Placement Report)</p> <p>Data source:</p>	<p>Students receiving an Associate degree in Chemistry intend to transfer to a four year institution to complete their baccalaureate degree not enter the work force.</p>	<input type="checkbox"/>	<input type="checkbox"/>	

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/RESPONSIBLE PARTY
Frequent employers: Quantity/quality of employer feedback(if available): Summary of graduate surveys				

SUMMARY AND RECOMMENDATIONS: (provide a brief narrative summary of the analysis and recommendations):

Curriculum Proposal completed date (if applicable):

Curriculum Committee approved date (if applicable):

Cluster leader signature (**REQUIRED**):

Bloom’s Taxonomy Resources:

http://epltt.coe.uga.edu/index.php?title=Bloom%27s_Taxonomy

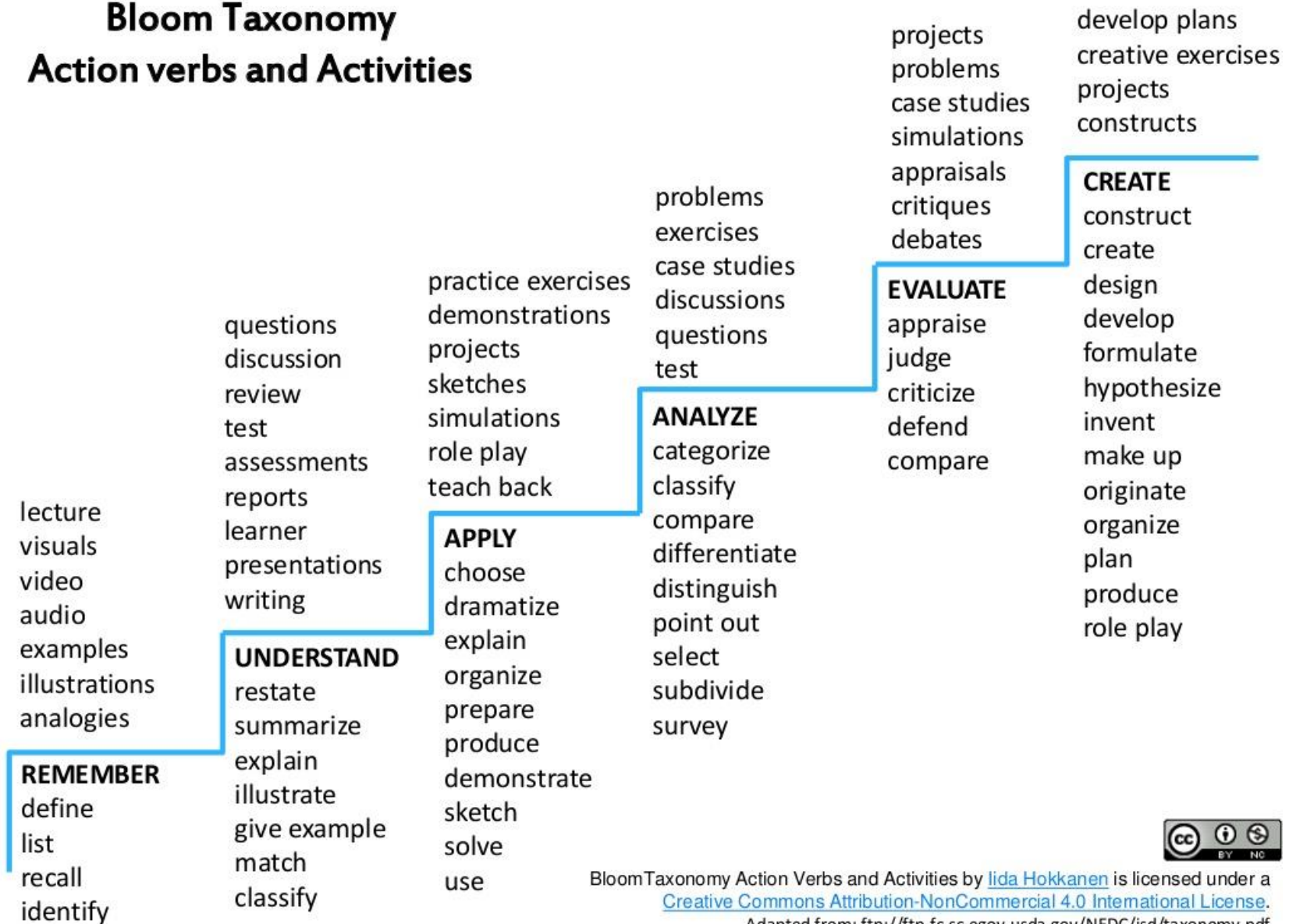
<https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>

REMEMBER	UNDERSTAND	APPLY	ANALYZE	EVALUATE	CREATE
Count	Associate	Add	Analyze	Appraise	Categorize
Define	Compute	Apply	Arrange	Assess	Combine
Describe	Convert	Calculate	Breakdown	Compare	Compile
Draw	Defend	Change	Combine	Conclude	Compose
Identify	Discuss	Classify	Design	Contrast	Create
Label	Distinguish	Complete	Detect	Criticize	Drive
List	Estimate	Compute	Develop	Critique	Design
Match	Explain	Demonstrate	Diagram	Determine	Devise
Name	Extend	Discover	Differentiate	Grade	Explain
Outline	Extrapolate	Divide	Discriminate	Interpret	Generate
Point	Generalize	Examine	Illustrate	Judge	Group
Quote	Give examples	Graph	Infer	Justify	Integrate
Read	Infer	Interpolate	Outline	Measure	Modify
Recall	Paraphrase	Manipulate	Point out	Rank	Order
Recite	Predict	Modify	Relate	Rate	Organize
Recognize	Rewrite	Operate	Select	Support	Plan
Record	Summarize	Prepare	Separate	Test	Prescribe
Repeat		Produce	Subdivide		Propose
Reproduce		Show	Utilize		Rearrange
Select		Solve			Reconstruct
State		Subtract			Related
Write		Translate			Reorganize
		Use			Revise
					Rewrite

Drawn from: https://www.depts.ttu.edu/opa/resources/docs/Writing_Learning_Outcomes_Handbook3.pdf

Bloom Taxonomy

Action verbs and Activities



Bloom Taxonomy Action Verbs and Activities by [Iida Hokkanen](#) is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](#).
Adapted from: <ftp://ftp-fc.sc.egov.usda.gov/NEDC/isd/taxonomy.pdf>

**ACADEMIC AUDIT FINANCIAL DATA
2018-19**

Chemistry Degree

	FY2019	FY2018	FY2017	FY2016	FY2015
Program Income					
Tuition	223,890	201,620	182,616	174,099	151,632
Local Reimb	38,045	33,458	29,962	27,958	24,611
Operating Reimb	88,999	76,395	68,912	50,945	42,624
Stipend Reimb					
Total Income	350,934	311,473	281,490	253,002	218,867
Program Costs					
Direct Costs	157,517	126,552	112,159	102,033	97,109
Indirect Costs	173,734	143,827	122,976	114,452	100,074
Total Costs	331,252	270,378	235,135	216,485	197,183
FTE	45.28	41.69	38.65	37.34	33.90
Income per FTE	7,750	7,472	7,282	6,776	6,456
Cost per FTE	7,316	6,486	6,083	5,798	5,817
Inst Avg Cost per FTE	7,933	7,075	6,703	6,416	6,144
Rank	87 of 133	87 of 126	102 of 132	106 of 129	71 of 119