

UNDERGRADUATE HANDBOOK



NEW STUDENT ORIENTATION · SUMMER 2023

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Student Handbook

Virginia Tech Department of Chemistry

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Table of Contents

Introduction and Key Links	2
Degree Programs	3
Minimum Grade Requirements for Progress Toward a Degree	4
Recommended Course Schedules	5
Pathways General Education	5
Prerequisites and Co-requisites	6
B.S. in Chemistry – Major in Chemistry	7
B.S. in Chemistry – Major in Medicinal Chemistry	8
B.S. in Chemistry – Major in Polymer Chemistry	9
B.A. in Chemistry	10
Advising	11
Highlights from the Undergraduate Catalog (Academic Policies)	12
Undergraduate Research	16
Clubs and Organizations	17
Your Well-Being and Work-Life Balance	18
Inclusion and Diversity	19
Disability and Special Needs	19
Conflict and Discrimination	20
Course Descriptions	21

Introduction

Welcome to the Chemistry Department at Virginia Tech! Chemistry has earned the nickname *Central Science* for its obvious and critical connections to everything in our physical world – from physics to the life sciences and from deep-sea environments to the farthest reaches of space. Chemistry is about *material transformations and energetics at the molecular level*. Molecules are transforming everywhere – a few at a time in the ozone layer or in vast numbers within plastics or human cells. Chemists use their training and creativity to improve quality of life by creating new drugs, inventing new materials, improving the efficiency of processes, developing new energy systems, and providing critical data for policy decisions.

Key Links to Official Documents and Information at Virginia Tech

While this Handbook is designed to outline your degree requirements in Chemistry and to answer many of the most common student questions, always remember that there are official sources for all of the information provided herein. In particular:

1. Main Chemistry Department website for undergraduate students:

- <http://www.chem.vt.edu/undergrad>

2. The Virginia Tech Undergraduate Catalog is the official reference source on academic policies.

- <https://catalog.vt.edu/undergraduate/>

3. Degree requirements are spelled out in official documents known as Checksheets. Requirements can change year-to-year, so you should always refer to the appropriate checksheet. When you first join Virginia Tech, you are bound to the checksheet and the full set of Catalog policies for your year of entry. So, if you entered in the Fall of 2023 or the Spring of 2024, the Registrar's link for your checksheet will say "**2023/2024**" and those links will be activated during the preceding summer (Summer of 2023).

- <https://chem.vt.edu/undergraduate/degree-programs.html>
- <https://www.registrar.vt.edu/graduation-multi-brief/checksheets.html>

4. The College of Science maintains a web page with many of the academic forms that you may need from time to time, along with instructions for submitting them. Always read the instructions carefully!

- <https://www.science.vt.edu/academics/advising/forms.html>

Chemistry Degree Programs at Virginia Tech

Virginia Tech offers two curricula leading to undergraduate degrees in Chemistry. One is the Bachelor of Science (B.S.) in Chemistry and the other is the Bachelor of Arts (B.A.) in Chemistry. Our **B.S. degree** prepares students for industrial jobs, graduate school, and other STEM-oriented careers. Your education can be expanded by adding a minor or even a second major – but the Chemistry B.S. degree is intended to function *by itself* as an educational platform for career development. Our **B.S. degree** offers three distinct majors that are listed here and then described in more detail below.

- B.S. in Chemistry – Major in Chemistry (our traditional ACS-Certified, all-inclusive program)
- B.S. in Chemistry – Major in Medicinal Chemistry (tailored for life sciences)
- B.S. in Chemistry – Major in Polymer Chemistry (tailored for materials science)

B.S. in Chemistry – Major in Chemistry – CHEM

The CHEM curriculum includes all areas of chemistry with laboratory courses, five semesters of math, and a full year of engineering physics with lab. Only our CHEM program is fully certified by the American Chemical Society (ACS). This degree and major prepares students for careers as professional chemists in industry or government or to continue their academic training in graduate study in chemistry or related fields. It is also suitable to prepare for professional school or teaching at all levels.

B.S. in Chemistry – Major in Medicinal Chemistry – MDCH

The MDCH curriculum also prepares students for careers as professional chemists in industry or government or to continue their academic training in graduate study in chemistry or related fields. Specifically, students in this curriculum are interested in the pharmaceutical field or plan to attend pharmacy, medical, dental, or other health-related professional programs after graduation. The MDCH curriculum does not include inorganic chemistry or polymer chemistry. This curriculum includes three semesters of math and the life-sciences versions of physics and physical chemistry. The MDCH curriculum is often chosen as a second major by students pursuing degrees in the College of Agriculture and Life Sciences (CALs).

B.S. in Chemistry – Major in Polymer Chemistry – POLY

The POLY curriculum also prepares students for careers as professional chemists in industry or government or to continue their academic training in graduate study in chemistry or related fields. This curriculum gives the student additional expertise in the critically important field of polymer chemistry with additional courses in this area. The POLY curriculum does not include inorganic chemistry, bioorganic chemistry, or quantum mechanics. This curriculum includes four semesters of math and a full year of engineering physics with labs. The POLY curriculum is often chosen as a second major by students pursuing a B.S. in Chemical Engineering.

B.A. in Chemistry – Major in Chemistry

Our B.A. degree is intended to support and supplement another major, or to allow students to build their own diversified educational programs toward individual goals, such as high-school teaching, law, health professions, or business. The B.A. also provides a fallback for students who have struggled in college but still wish to graduate with a chemistry degree in a timely fashion. Against that background, we rarely recommend that a student start college in our B.A. program. Due to the math requirements of the B.S. degree, it is easier to start on a B.S. and switch to the B.A. rather than vice versa. Our B.A. has only one major – Chemistry.

Minimum Grade Requirements for Progress Towards Degree

For students who started as Chemistry Majors at Virginia Tech

Upon having attempted 72 credits, a student must have completed CHEM 1055-1056, CHEM 1065-1066, CHEM 1004, CHEM 2565-2566, CHEM 2555-2556, PHYS 2305-2306, and MATH 1225-1226, all with the required grades as described below.

Chemistry majors must maintain both overall AND in-major GPAs of 2.0. If a chemistry major fails to meet this requirement for one academic term the student will be placed on academic probation. Failure to meet the standard for two consecutive terms will result in suspension.

Minimum Grades in Chemistry Courses:

- Chemistry majors must earn a grade of “C” or better in CHEM 1055, CHEM 1056, and CHEM 2565.
- A Chemistry major who earned a grade lower than “C” in CHEM 1055 may repeat this course and earn the required grade (“C” or better), or they may take CHEM 1035 and earn a “B” or better.
- A Chemistry major who earned a grade lower than “C” in CHEM 1056 may repeat this course and earn the required grade (“C” or better), or they may take CHEM 1036 and earn a “B” or better.
- A Chemistry major who earned a grade lower than “C” in CHEM 2565 may repeat this course and earn the required grade (“C” or better), or they may take CHEM 2535 and earn a “B” or better. A student repeating CHEM 2565 does not need to repeat CHEM 2564.

For students who transfer in or start at Virginia Tech as a major other than Chemistry, we offer a series of substitutions for general chemistry and organic chemistry.

General Chemistry Lecture Substitutions. A student who earned credit for CHEM 1035 with a grade of “B” or better prior to joining the major in Chemistry may substitute CHEM 1035 for CHEM 1055. A student who earned credit for CHEM 1036 with a grade of “B” or better prior to joining the major in Chemistry may substitute CHEM 1036 for CHEM 1056.

General Chemistry Lab Substitutions. A student who earned credit for CHEM 1045 prior to joining the major in Chemistry may substitute CHEM 1045 for CHEM 1065. A student who earned credit for CHEM 1046 prior to joining the major in Chemistry may substitute CHEM 1046 for CHEM 1066.

Organic Chemistry Lecture Substitutions. A student who earned credit for CHEM 2535 with a grade of “B” or better prior to joining the major in Chemistry may substitute CHEM 2535 for CHEM 2565. A student who is substituting CHEM 2535 for CHEM 2565 may also substitute one additional credit of free elective for the one credit CHEM 2564, since CHEM 2564 is meant as a companion course to CHEM 2565. A student who earned credit for CHEM 2536 with a grade of “B” or better prior to joining the major in Chemistry may substitute CHEM 2536 for CHEM 2566.

Organic Chemistry Lab Substitutions. A student who earned credit for CHEM 2545 prior to joining the major in Chemistry may substitute CHEM 2545 for CHEM 2555. To compensate for differences in content (mostly with respect to training on specific instrumentation), the substitution requires the student to enroll in one credit of CHEM 4994 with a project that uses the same types of instrumentation (such as IR and NMR). A student who earned credit for CHEM 2546 prior to joining the major in Chemistry may substitute CHEM 2546 for CHEM 2556. To compensate for differences in content (mostly with respect to training on specific instrumentation), the substitution requires the student to enroll in one credit of CHEM 4994 with a project that uses the same types of instrumentation (such as IR and NMR).

How to Use the Recommended Course Schedules

Select the course schedule for your degree and major. If you have any doubts about your course requirements, check the [Registrar's Office Checksheets](#) or consult with your academic advisor.

The **CR** column shows you the number of credits corresponding to each course.

Prerequisites and Co-requisites. Almost all of your courses have prerequisites or co-requisites that you should look up on p. 6. Consult with your advisor if you have questions about prerequisites.

Pathways is the name given to the General Education (liberal arts core) of Virginia Tech's undergraduate system. Pathways consists of seven **Core Concepts**, which are listed below along with the number of credits corresponding to each. In our course schedules, General Education courses are marked with codes starting with the letter **P** as follows:

P1F – Discourse, foundational (6 credits, two semesters of First-Year Writing are recommended)

P1A – Discourse, advanced or applied (3 credits)

P2 – Critical thinking in the humanities (6 credits)

P3 – Reasoning in the social sciences (6 credits)

P4 – Reasoning in the natural sciences (8 credits, covered by physics)

P5F – Quantitative and computational thinking, foundational (6 credits, covered by calculus)

P5A – Quantitative and computational thinking, advanced (3 credits, covered by statistics)

P6A – Critique and practice in design (3 credits)

P6D – Critique and practice in the arts (3 credits)

P7 – Critical analysis of identity and equity in the U.S. (3 credits).

→ Key Time-Saver: Concept No. 7 is the **only** Pathways Concept that may be double-counted with another by taking a single course. Concept No. 7 is often combined with Concept No. 2. For example, HIST 1115 (History of the United States) counts three credits toward P2 and three credits toward P7. Consult the cross-table (below) for more options.

A useful cross-list table to find courses that cover various Pathways concepts has been provided by the Provost's Office:

- https://www.apps.provost.vt.edu/pathways/table2_rep.html

Readiness for General Chemistry and Calculus of a Single Variable

Virginia Tech requires students to demonstrate a sufficient background in quantitative reasoning in order to enroll in MATH 1225 Calculus of a Single Variable, CHEM 1035 General Chemistry, or CHEM 1055 General Chemistry for Majors. This readiness can be verified in several ways, but the simplest is to take the ALEKS assessment that is offered prior to the start of each Fall semester. To enroll in CHEM 1035 or CHEM 1055, you need an ALEKS score of 61 or higher, otherwise you will be asked to complete CHEM 1014 before enrolling in General Chemistry. To enroll in MATH 1225, you need an ALEKS score of 80 or higher, otherwise you will be asked to complete MATH 1214 before enrolling in Calculus of a Single Variable.

- <https://chem.vt.edu/undergraduate/chem-readiness.html>

Course	Prerequisites and Corequisites
BIOL 1115, 1116	Co: 1105 for 1115; 1106 for 1116.
CHE 4104	Pre: CHE 2164, (CHEM 2535 or CHEM 2565).
CHEM 1055 – 1056	Co: 1065 for 1055; 1066 for 1056. Pre: CHEM 1055 requires the same ALEKS placement exam that is required for CHEM 1035. Refer to this page for help: https://chem.vt.edu/undergraduate/chem-readiness.html
CHEM 1065 – 1066	Co: 1055 for 1065; 1056 for 1066.
CHEM 2154	Pre: 1036 or 1056 or 1056H. Co: 2164
CHEM 2164	Pre: 1046 or 1066. Co: 2154
CHEM 2424	Pre: 1036 or 1056
CHEM 2555 – 2556	Pre: 2565 for 2555; 2555 for 2556
CHEM 2565 – 2566	Pre: 1036 or 1056 or 1056H for 2565; 2565 for 2566
CHEM 3615 – 3616	Pre: (1035 or 1055 or 1055H), (1036 or 1056 or 1056H), PHYS 2306, (MATH 2204 or MATH 2204H or MATH 2225) for 3615; MATH 2214, (CHEM 3615 or CHEM 3615H), (CHEM 3615, MATH 2214 or CHEM 3615H) for 3616.
CHEM 3625 – 3626	Pre: 3615 or 3615H or 4615 for 3625; (3616 or 3616H or 4616, 3625, 4014 for 3626.
CHEM 4014	Pre: Junior Standing
CHEM 4044	Pre: (3616 or 3616H), 2424
CHEM 4074	Pre: 3615 and 4534.
CHEM 4414	Pre: 2424, (3616 or 3616H), 4404. Co: 4424, 3616
CHEM 4424	Pre: 2536 or 2566; course is cross-listed with SBIO 4424
CHEM 4524	Pre: (2536 or 2566) and (3616 or 3616H or 4616).
CHEM 4534	Pre: 2536 or 2566
CHEM 4444	Pre: (2536 or 2566) and (3616 or 3616H or 4616).
CHEM 4544	Pre: 4584, BIOL 1105, BIOL 1106.
CHEM 4554	Pre: 2536 or 2566
CHEM 4584	Pre: 2536 or 2566
CHEM 4615, 4616	Pre: (1036 or 1056 or 1056H) and (MATH 1026 or MATH 2015 or MATH 1226) and (PHYS 2205 or PHYS 2305) for both 4615 and 4616. Note that CHEM 4615 and CHEM 4616 may be taken in either order.
CHEM 4634	Pre: 3615 or 4615; course is cross-listed with MSE 4534
MATH 1225 – 1226	Pre: 1225 (C-) for 1226
MATH 2114	Pre: MATH 1225 or MATH 1226
MATH 2204	Pre: MATH 1226
MATH 2214	Pre: (1114 or 1114H or 2114 or 2114H), (1206 or 1226)
PHYS 2205 – 2206	Pre: MATH 1016 or MATH 1016H or MATH 1025 or MATH 2015 or MATH 1026 or MATH 1205 or MATH 1205H or MATH 1525 or MATH 1535 or MATH 1225 or MATH 1225H for 2205; Pre: PHYS 2305 or 2205 for 2206.
PHYS 2305 – 2306	Pre: (MATH 1205 or MATH 1205H or MATH 1225) or (MATH 1206 or MATH 1206H or MATH 1226) for PHYS 2305; (MATH 1206 or MATH 1206H or MATH 1226), PHYS 2305 for PHYS 2306. Co: 2325 or (MATH 1206 or MATH 1206H or MATH 1226) for PHYS 2305
PHYS 4564	Pre: PHYS 2306
STAT 3005	Pre: MATH 1205 or MATH 1225; Co: MATH 1206 or MATH 1226
STAT 3615	Pre: MATH 1205 or MATH 1225 or MATH 1025 or MATH 1525

B.S. in Chemistry – Major in Chemistry – CHEM Recommended Course Schedule

Academic Plan for students entering calendar year 2023-2024. This tentative schedule can be rearranged, so long as you meet the prerequisites for the courses you plan to take in a given term. Consult your advisor.

Start by reading the guide on p. 5 so that you will know what information is provided here.

Almost all of your courses have prerequisites or co-requisites as shown on p. 6. You must keep track of the requirements for entry into the courses that you choose for your program, especially courses selected from a range of elective choices.

Fall Semester Freshman 2023	16 CR	Spring Semester Freshman Year 2024	16 CR
CHEM 1004 First Year Experience in Chemistry	1	CHEM 2565 Principles of Organic Chemistry	3
CHEM 1055 General Chemistry for Majors	4	CHEM 2555 Organic Synthesis & Techniques Lab	2
CHEM 1065 General Chemistry for Majors Lab	1	CHEM 2564 Problem Solving in Organic Chemistry	1
MATH 1225 Calculus of a Single Variable (P5F)	4	MATH 1226 Calculus of a Single Variable (P5F)	4
ENGL 1105 First-Year Writing (P1F)	3	ENGL 1106 First-Year Writing (P1F)	3
Pathways Concept 3 (P3)	3	MATH 2114 Elementary Linear Algebra	3
Fall Semester Sophomore 2024			
	17 CR		16 CR
CHEM 1056 General Chemistry for Majors	4	CHEM 2154 Majors Analytical Chemistry	4
CHEM 1066 General Chemistry for Majors Lab	1	CHEM 2164 Majors Analytical Chemistry Lab	1
CHEM 2566 Principles of Organic Chemistry	3	CHEM 4014 Survey of the Chemical Literature	1
CHEM 2556 Organic Synthesis & Techniques Lab	2	CHEM 2424 Descriptive Inorganic Chemistry	3
MATH 2204 Introduction to Multivariable Calculus	3	MATH 2214 Introduction to Differential Equations	3
PHYS 2305 Foundations of Physics (P4)	4	PHYS 2306 Foundations of Physics (P4)	4
Fall Semester Junior 2025			
	13 CR		13 CR
CHEM 3615 Physical Chemistry	3	CHEM 3616 Physical Chemistry	3
CHEM 4584 Bioorganic Chemistry	3	CHEM 3625 Physical Chemistry Lab	1
CHEM 3004 Bridge to the Future	1	CHEM 4114 Instrumental Analysis	3
Pathways Concept 2 (P2)	3	STAT 3005 or STAT 3615 Statistics Elective (P5A)	3
Pathways Concept 7 (P7)	3	Pathways Concept 3 (P3)	3
Fall Semester Senior 2026			
	14 CR		15 CR
CHEM 3626 Physical Chemistry Lab	1	CHEM 4414 Inorganic Chemistry Laboratory	2
CHEM 4424, 4534, or 4634 (Polymer Chemistry Elective)	3	CHEM or BCHM or CHE 4XXX (Advanced Elective)	3
CHEM 4404 Physical Inorganic Chemistry	3	Pathways Concept 2 (P2)	3
CHEM 4124 Instrumental Analysis Lab	1	Pathways Concept 6 (P6A or P6D)	3
Pathways Concept 1 Advanced or Applied (P1A)	3	Free Electives	4
Pathways Concept 6 (P6D or P6A)	3		

B.S. in Chemistry – Major in Medicinal Chemistry – MDCH Recommended Course Schedule

Academic Plan for students entering calendar year 2023-2024. This tentative schedule can be rearranged, so long as you meet the prerequisites for the courses you plan to take in a given term. Consult your advisor.

Start by reading the guide on p. 5 so that you will know what information is provided here.

Almost all of your courses have prerequisites or co-requisites as shown on p. 6. You must keep track of the requirements for entry into the courses that you choose for your program, especially courses selected from a range of elective choices.

Fall Semester Freshman 2023	17 CR	Spring Semester Freshman Year 2024	17 CR
CHEM 1004 First Year Experience in Chemistry	1	CHEM 2565 Principles of Organic Chemistry	3
CHEM 1055 General Chemistry for Majors	4	CHEM 2555 Organic Synthesis & Techniques Lab	2
CHEM 1065 General Chemistry for Majors Lab	1	CHEM 2564 Problem Solving in Organic Chemistry	1
MATH 1225 Calculus of a Single Variable (P5F)	4	MATH 1226 Calculus of a Single Variable (P5F)	4
BIOL 1105 Principles of Biology	3	BIOL 1106 Principles of Biology	3
BIOL 1115 Principles of Biology Laboratory	1	BIOL 1116 Principles of Biology Laboratory	1
ENGL 1105 First-Year Writing (P1F)	3	ENGL 1106 First-Year Writing (P1F)	3
Fall Semester Sophomore 2024	17 CR	Spring Semester Sophomore 2025	13 CR
CHEM 1056 General Chemistry for Majors	4	CHEM 2154 Majors Analytical Chemistry	4
CHEM 1066 General Chemistry for Majors Lab	1	CHEM 2164 Majors Analytical Chemistry Lab	1
CHEM 2566 Principles of Organic Chemistry	3	CHEM 4014 Survey of the Chemical Literature	1
CHEM 2556 Organic Synthesis & Techniques Lab	2		
PHYS 2205 General Physics (P4)	3	PHYS 2206 General Physics (P4)	3
PHYS 2215 General Physics Lab (P4)	1	PHYS 2216 General Physics Lab (P4)	1
Pathways Concept 3 such as SOC 1004 (P3)	3	Pathways Concept 6 (P6D or P6A)	3
Fall Semester Junior 2025	13 CR	Spring Semester Junior 2026	15 CR
CHEM 4615 Physical Chemistry for Life Sciences	3	CHEM 4616 Physical Chemistry for Life Sciences	3
CHEM 4584 Bioorganic Chemistry	3	STAT 3005 or STAT 3615 Statistics Elective (P5A)	3
CHEM 3004 Bridge to the Future	1	Pathways Concept 2 (P2)	3
Pathways Concept 2 (P2)	3	Pathways Concept 3 such as PSYC 1004 (P3)	3
Pathways Concept 7 (P7)	3	Pathways Concept 1 Applied or Advanced (P1A)	3
Fall Semester Senior 2026	14 CR	Spring Semester Senior 2027	14 CR
Advanced Electives*	3	CHEM 4544 Medicinal Chemistry Capstone Laboratory	2
Pathways Concept 6 (P6A or P6D)	3	Advanced Electives*	3
Free Electives	8	Free Electives	9

*Advanced electives: Student must choose a total of two courses (6 cr) from CHEM 4524, 4444, 4514, 4554, and 4424 (SBIO 4424).

B.S. in Chemistry – Major in Polymer Chemistry – POLY Recommended Course Schedule

Academic Plan for students entering calendar year 2023-2024. This tentative schedule can be rearranged, so long as you meet the prerequisites for the courses you plan to take in a given term. Consult your advisor.

Start by reading the guide on p. 5 so that you will know what information is provided here.

Almost all of your courses have prerequisites or co-requisites as shown on p. 6. You must keep track of the requirements for entry into the courses that you choose for your program.

Fall Semester Freshman 2023		16 CR	Spring Semester Freshman Year 2024		16 CR
CHEM 1004 First Year Experience in Chemistry	1		CHEM 2565 Principles of Organic Chemistry	3	
CHEM 1055 General Chemistry for Majors	4		CHEM 2555 Organic Synthesis & Techniques Lab	2	
CHEM 1065 General Chemistry for Majors Lab	1		CHEM 2564 Problem Solving in Organic Chemistry	1	
MATH 1225 Calculus of a Single Variable (P5F)	4		MATH 1226 Calculus of a Single Variable (P5F)	4	
ENGL 1105 First-Year Writing (P1F)	3		ENGL 1106 First-Year Writing (P1F)	3	
Pathways Concept 3 (P3)	3		Pathways Concept 2 (P2)	3	
Fall Semester Sophomore 2024		17 CR	Spring Semester Sophomore 2025		13 CR
CHEM 1056 General Chemistry for Majors	4		CHEM 2154 Majors Analytical Chemistry	4	
CHEM 1066 General Chemistry for Majors Lab	1		CHEM 2164 Majors Analytical Chemistry Lab	1	
CHEM 2566 Principles of Organic Chemistry	3		CHEM 4014 Survey of the Chemical Literature	1	
CHEM 2556 Organic Synthesis & Techniques Lab	2				
PHYS 2305 Foundation of Physics (P4)	4		PHYS 2306 Foundation of Physics (P4)	4	
MATH 2204 Introduction to Multivariable Calculus	3		Pathways Concept 6 (P6A or P6D)	3	
Fall Semester Junior 2025		16 CR	Spring Semester Junior 2026		12 CR
CHEM 3615 Physical Chemistry	3		CHEM 3625 Physical Chemistry Laboratory	1	
CHEM 4534 Organic Chemistry of Polymers	3		CHEM 4074 Laboratory in Polymer Science	2	
CHEM 3004 Bridge to the Future	1		STAT 3005 or STAT 3615 (P5A)	3	
Pathways Concept 2 (P2)	3		Pathways Concept 3 (P3)	3	
Pathways Concept 7 (P7)	3		Free Electives	3	
Free electives	3				
Fall Semester Senior 2026		15 CR	Spring Semester Senior 2027		15 CR
CHEM 4524 or CHE 4104 or PHYS 4564 Elective	3		CHEM 4424 or CHEM 4634	3	
CHEM 4524 or CHE 4104 or PHYS 4564 Elective	3		Pathways Concept 6 (P6D or P6A)	3	
Pathways Concept 1, Advanced Applied (P1A)	3		Free Electives	9	
Free Electives	3				

B.A. in Chemistry – Major in Chemistry – BA Recommended Course Schedule

Academic Plan for students entering calendar year 2023-2024. This tentative schedule can be rearranged, so long as you meet the prerequisites for the courses you plan to take in a given term. Consult your advisor.

Start by reading the guide on p. 5 so that you will know what information is provided here.

Almost all of your courses have prerequisites or co-requisites as shown on p. 6. You must keep track of the requirements for entry into the courses that you choose for your program, especially courses selected from a range of elective choices.

Fall Semester Freshman 2023	15 CR	Spring Semester Freshman Year 2024	16 CR
CHEM 1004 First Year Experience in Chemistry	1	CHEM 2565 Principles of Organic Chemistry	3
CHEM 1055 General Chemistry for Majors	4	CHEM 2564 Problem Solving in Organic Chemistry	1
CHEM 1065 General Chemistry for Majors Lab	1	ENGL 1106 First-Year Writing (P1F)	3
ENGL 1105 First-Year Writing (P1F)	3	MATH 1206 Elementary Calculus (P5F)	3
MATH 1025 Elementary Calculus (P5F)	3	Pathways Concept 2 (P2)	3
Pathways Concept 3 (P3)	3	Pathways Concept 7 (P7)	3
Fall Semester Sophomore 2024	13 CR	Spring Semester Sophomore 2025	14 CR
CHEM 1056 General Chemistry for Majors	4	CHEM 2154 Majors Analytical Chemistry	4
CHEM 1066 General Chemistry for Majors Lab	1	CHEM 2164 Majors Analytical Chemistry Lab	1
CHEM 2566 Principles of Organic Chemistry	3	CHEM 4014 Survey of the Chemical Literature	1
CHEM 2545 Organic Chemistry Lab	1	CHEM 2546 Organic Chemistry Lab	1
		CHEM 2424 Descriptive Inorganic Chemistry	3
PHYS 2205 General Physics (P4)	3	PHYS 2206 General Physics (P4)	3
PHYS 2215 General Physics Lab (P4)	1	PHYS 2216 General Physics Lab (P4)	1
Fall Semester Junior 2025	16 CR	Spring Semester Junior 2026	16 CR
CHEM 4615 Physical Chemistry for Life Sciences	3	CHEM 4616 Physical Chemistry for Life Sciences	3
CHEM 3004 Bridge to the Future	1	CHEM 3625 Physical Chemistry Lab	1
STAT 3615 or STAT 3005 (P5A)	3	Pathways Concept 3 (P3)	3
Pathways Concept 2 (P2)	3	Free Electives	9
Pathways Concept 1, Advanced or Applied (P1A)	3		
Free Elective	3		
Fall Semester Senior 2026	15 CR	Spring Semester Senior 2027	15 CR
CHEM or BCHM or CHE 3XXX or 4XXX Elective	3	CHEM or BCHM or CHE 3XXX or 4XXX Elective	3
Pathways Concept 6 (P6D or P6A)	3	Pathways Concept 6 (P6A or P6D)	3
Free Electives	9	Free Electives	9

Advising

Advising is one of the core strengths of the Chemistry Department. Advising provides you with guidance to help you make important decisions. Your advisor will provide advice on what he or she thinks will serve you best. Life – including college – is a journey full of expected and unexpected curves with many different paths. We are here to help you make decisions that seem right for you.

It stands to reason that if you never meet with your advisor, then you are missing potentially valuable guidance that you have already paid for with your tuition and fees. You should meet each semester with your advisor at minimum, and not necessarily only to choose your courses for the next term. Your advisor is a resource to help you prepare yourself for a rewarding career.

Your professors and advisors want and expect to know every chemistry major personally. As you move through the program, please try to meet and know your professors; they are available for help and guidance. A complete and current faculty listing is found on the department website (www.chem.vt.edu). Students may schedule appointments directly with their advisors whenever questions or issues arise.

Core Advising Team

- Prof. Paul A. Deck, Director of Undergraduate Programs, Freshman & Sophomore Advising
2101 Hahn Hall South, pdeck@vt.edu
- Amy Kokkinakos, Undergraduate Program Coordinator, Academic Advisor
117B Davidson Hall, amyk@vt.edu
- Dr. Tim Saarinen, Professor of Practice, Academic and Career Advisor
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- Dr. Jeannine Eddleton, Freshman & Sophomore Advising, Teacher Certification
109 Davidson Hall, jeddleto@vt.edu

Health Professions Advising

- For many years, the Chemistry Department maintained its own office for health-professions advising. The breadth of the health professions has made this task impossible. Students are encouraged to consult with our Career Advisor (Dr. Tim Saarinen, tsaarinen29@vt.edu) with general questions and to use the university's [Health Professions Advising Center](#) for detailed assistance with preparation for medical, dental, pharmacy, veterinary, and other health-professional graduate programs.

Expectations

Student advising is a two-way street. The link below shares the “top ten” expectations for student advising within the College of Science. The Chemistry Department Advising Team follows these principles, each of which assigns responsibilities to both the advisor and the student. Remember: It's your degree program!

- <https://www.science.vt.edu/academics/advising/expectations.html>

Highlights from the Undergraduate Catalog (Academic Policies)

The following is a general summary. Refer to the complete text in the Undergraduate Course Catalog (<https://catalog.vt.edu/undergraduate/> -- click on "Academic Policies" in the menu at left) for full details.

Academic Eligibility Policy

A GPA of 2.0 (a C average) overall and in-major is required for graduation. Any time your overall GPA falls below 2.0 you are placed on academic probation. Probation is lifted when your GPA is again at least 2.00. The policy on academic probation, suspensions, and appeals is extensive. See the [Catalog](#) for details.

Registration for Classes

Course Request (pre-registration) is a period in the middle of each semester during which students enrolled currently may select classes for the following semester. Prior to, or during, course request, you should plan your schedule, consult with your advisor, and utilize course request/Hokie scheduler in Hokie SPA.

Course Loads

A student is classified as "full-time" if enrolled for 12 credits in fall and spring semesters and/or 6 credits during a summer session. A normal course load is 15-17 credits per semester. Overloads (more than 19 credits per semester, or seven each summer session, or six for winter session) require prior, written permission from your Academic Dean's office.

Late Adds

Adding a course to your schedule after the deadline requires permission of your Academic Dean.

Grade Options

Students may take certain courses on a pass-fail basis, according to the following regulations:

- No Pathways requirements or Chemistry Department degree requirements may be taken pass-fail. Essentially, none of the courses listed in the 4-year course plans in this Handbook can be taken P/F.
- Minimum credit hours already passed on graded courses must equal 30 with a minimum GPA = 2.50. (Does not apply for courses offered only on a pass-fail basis.)
- Maximum number of pass-fail credits allowed = 10% of the requirements for graduation taken at Virginia Tech. For example, if a student takes 120 credits at Virginia Tech, 12 hours may be taken Pass-Fail. If a student takes only 90 credit hours at Virginia Tech (with 30 transfer credits), then only 9 (10% of 90) credits may be taken Pass-Fail.
- For courses taken pass-fail, P or F is recorded on the student's transcript and credit is given if the grade is P. If the course is failed, the "F" is considered as an "F" received under the "A-F" grading system and is included in calculation of the GPA.
- Pass-fail courses are normally non-transferable to other institutions.
- No more than 2 courses may be taken pass-fail in any semester unless they are offered only pass-fail.

Enrollment in Graduate Courses

- With permission of the instructor, senior chemistry majors with a 3.0 GPA may enroll in 5000-level chemistry courses. Chemistry majors wishing to take 5000-level courses in other departments must have the approval of the instructor and the Dean of the Graduate School.

Course Drop and Withdrawal

Dropping a course: Students may drop courses prior to a specific deadline that is announced for each term; the course is removed from your transcript. If you will have fewer than 12 credits after dropping a course, then you may jeopardize scholarships or athletic eligibility. Consult with your advisor in this situation.

Course Drop Involving Co-Requisite Courses (Lecture and Lab)

A common issue that arises in science courses is the co-requisite relationship between lecture and lab courses. In Chemistry, if you drop a lab course you may generally continue in the lecture course. However, if you drop a lecture course *before the drop deadline* then you are expected to drop the lab course also. After the drop date, then you may keep the lab course.

Course Withdrawal: A maximum of three (3) courses may be dropped beyond the normal drop deadline date during a student's academic career at Virginia Tech, subject to the following stipulations:

1. Students must formally request to withdraw from a course **by the last day of classes** in that term. The form is provided here: <https://www.science.vt.edu/academics/advising/forms.html>. The form must be approved by the student, the student's advisor, and the academic dean.
2. Courses from which a student withdraws under the terms of this policy will appear on their transcript with a W. The W signifies that this policy was invoked; the reasons for its use are the (private) responsibility of the student.
3. A student's decision to invoke this policy is irrevocable and unappealable.
4. Withdrawals may not be employed to reduce or obviate any penalty otherwise accruing to students under the University Honor System.
5. Students may request withdrawal from any course, irrespective of the grade earned to that point.

Repeated and Duplicated Courses

A course that partially or wholly duplicates another (already taken) course does not count toward graduation. Duplication of two courses does not necessarily mean that they are equivalent; rather, it means that there is sufficient material overlap that credit is not allowed for both. No credit will be given toward graduation for duplicated courses nor may duplicate courses be used for GPA enhancement unless the grade in the course already taken is a C- or less. Students may repeat courses in which they received grades of C- or below, however a student may only attempt a course three times. An "attempt" is when a student is enrolled in a course on the last day to add courses during each semester. Courses designated as repeatable credit (to the limit allowed) are excluded from this policy (e.g. undergraduate research, etc.). Both grades stay on the record and figure into the overall and in-major GPA, but the course hours count only once toward graduation. Transcripts will display all hours attempted whether or not they count toward graduation. Repeating a course may affect financial aid and eligibility for certain programs for veterans, athletes, and international students.

Attendance in Class

It is the policy of the Chemistry Department that students must attend all timetable-scheduled lectures, labs, and recitations *for all of their courses*, not just chemistry courses. However, students who are sick should stay home and avoid infecting others. *It is considered polite to send your instructors a note indicating that you must miss lecture due to illness.* Normally, in lab courses, such notifications are absolutely required.

Incomplete Grades

When a student has missed an assignment or two in the latter portion of a semester, or missed the final exam, an instructor may assign an Incomplete ("I") grade, giving the student more time to complete the work. Assignment of Incomplete grade is the sole discretion of the course instructor. After completion and grading, the instructor can then enter a final grade (A to F or P/F) for the student. The instructor and student must have a written agreement as to the absolute deadline for completion of the missed work. The deadline must be *before the end of the next regular term*. Resources for completion of the work cannot include attending lectures or gaining access to Canvas in a subsequent term. In addition, there can be no lab activities after the end of the enrolled term. If the completion deadline is missed, then zeroes are assigned for work that has not been completed. If the instructor fails to enter a new grade, the Registrar's Office will replace the "I" grade with an "F". An "incomplete" is not intended for a situation where a student has missed a significant portion of the graded work for the term, or when assignments or exams were missed during the early part of the term, because those issues should have been rectified sooner. Students who have missed a lot of work for a course during a given term should use "W" or consider Academic Relief. The intention is to use any of these means of relief rarely, but they do have a purpose.

Transfer Credit

Students transferring to Virginia Tech from a community college may transfer as many as 60 credits. Those who transfer from a four-year college have no such limitation. However, all students must take at least 27 of their last 45 hours at Virginia Tech. Also, chemistry majors and minors must take at least 25% of the required chemistry courses at Virginia Tech.

More information is available online at the University Registrar's website: <http://www.registrar.vt.edu>. Transfer students should also review the Transfer Guide: <https://transferguide.registrar.vt.edu/>

Students frequently wish to take summer school courses at other institutions for transfer back to Virginia Tech. The student should contact the college or university they wish to attend to determine what courses will be offered. An "Authorization to Take Courses Elsewhere" form should be obtained from the student's advisor or primary major's academic dean's office. For students whose (primary) major is chemistry, the form may be found in the College of Science's administrative office or from the COS forms webpage:

- <https://www.science.vt.edu/academics/advising/forms.html>

The Authorization form must be returned to the Dean's office at least 3 weeks before matriculation at the other institution. An evaluator will determine whether the desired courses will transfer as expected, and you will receive an email when the request form has been reviewed. After the courses are completed, the student must request that an official transcript be sent to the University Registrar at Virginia Tech.

Double Majors and Second Degrees

Students who complete the requirements for two majors within the same academic term are considered Double Majors. Students receive a diploma for the primary major (degree) and a double major certificate for the secondary major (double major).

Students may complete the requirements for a Second Degree in a different academic term. Students pursuing a Second Degree must complete an additional 30 credits over the minimum required for their first degree. Students will receive a separate diploma for each degree. You should indicate on your Application for Degree on Hokie SPA if your secondary major should be a double major or a second degree.

Minors

Any department that offers a major may offer a minor. If you desire a minor in a particular subject, contact the appropriate department for their requirements or ask your advisor. Note that Majors and Minors are supposed to be added before senior year. A full listing of minors can be found on the Registrar's website:

- <https://www.registrar.vt.edu/graduation-multi-brief/checksheets.html>

Graduation

You should apply for your Degree on Hokie Spa during the first semester of your junior year. You may then generate a Degree Audit Report System (DARS) report in Hokie Spa to review your record to see what requirements remain to be completed for graduation. Applying for your degree early ensures that you will have time to take courses that you may have overlooked, and it allows you and your advisor to correct the Registrar's analysis if errors are present. Finally, you should be advised that the Registrar's graduation analysis is not a binding contract. Do not assume that you are excused from a required course on the basis of error in DARS; the Registrar will eventually find the mistake and you will not graduate.

Other General Requirements

1. No more than 60 hours in the major may be counted towards the total number of hours required for graduation.
2. Students who receive Advanced Standing (with credit) for ENGL 1105 need only to take 1106.
3. Students must demonstrate proficiency in a foreign language equivalent to one year of university instruction. This requirement can be met in several ways:
 - a. Completing the third year (Level III) of a language in high school.
 - b. Completing two years each of two different foreign languages in high school (for COS majors).
 - c. Completing the 1106 course in Chinese, French, German, Greek, Italian, Japanese, Latin, Portuguese, Russian, or Spanish, including any prerequisites.
 - d. NOTE: Students who have not completed foreign language requirements in high school may not count these hours toward the 120 required for graduation.
 - e. Passing an oral examination in a language not taught at Virginia Tech.
 - f. Documenting that English is not your primary language (see Department of Foreign Languages & Literatures for obtaining documentation).

Honors College

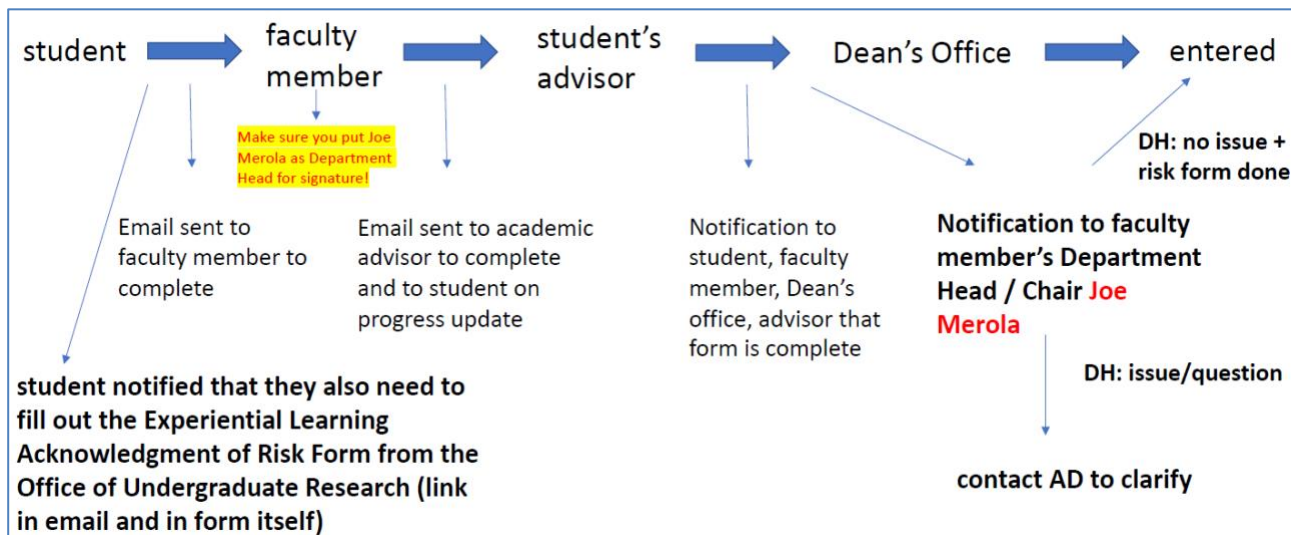
The Chemistry Department has faculty members who are active participants in the Honors College at Virginia Tech. We offer honors sections of several lecture courses to all students of the University, and we encourage our majors who are eligible to apply to the Honors College and pursue an Honors Laureate Diploma.

Additional information on the Honors College can be found at (<http://www.honorscollege.vt.edu/>), or by calling their office to speak with someone or to schedule an appointment – (540) 231-4591. The Chemistry Department’s liaison to the Honors College is Prof. Gordon Yee (HHS 2103, gyee@vt.edu).

Undergraduate Research

Chemistry majors are strongly encouraged to undertake a research project in collaboration with at least one faculty member. Credit for this activity is obtained by enrolling in CHEM 4994 for those semesters (potentially including summers) in which the work is to be performed. Chemistry faculty can suggest either short-term (one semester) or long-term projects; in every case, undergraduate research projects are designed to meet the individual interests and needs of the student. An interested student should consult with a prospective research mentor at least several weeks prior to the academic term in which s/he wants to register for undergraduate research. The student and research mentor must complete the “Undergraduate Research” form, which is available at <https://www.science.vt.edu/academics/advising/forms.html>. Students need a minimum 2.0 in-major GPA, a minimum 2.5 overall GPA, and a minimum of 28 credits completed at Virginia Tech to enroll in CHEM 4994.

The form will have the following workflow:



Three credits of CHEM 4994 Undergraduate Research may substitute for the 3-credit Restricted Elective requirement only in the Major in Chemistry (CHEM) within the B.S. degree. Sufficient flexibility has been designed into the Medicinal Chemistry (MDCH) and Polymer Chemistry (POLY) degrees that substitution of research for elective credit is not warranted.

Clubs and Organizations

One of the big advantages of a large public institution like Virginia Tech is the breadth of opportunity beyond the classroom. Are you a poet? A musician? A dancer? A stand-up comedian? Do you enjoy video games or hiking or bowling or ping-pong or working out? Do you want to socialize with others who share your characteristics or your interests or your world view? Virginia Tech offers innumerable clubs, organizations, and cultural centers to explore and nurture your unique mix of interests.

Your advisor may ask you, from time to time, whether you have joined any clubs or organizations. That's because we recognize their value in maintaining a wholesome and healthy lifestyle, even as a busy student. Members of the Virginia Tech faculty and staff are people, too, with hobbies and lives beyond the university.

There are two student groups affiliated with the Chemistry Department at Virginia Tech: Alpha Chi Sigma, the co-ed professional chemistry fraternity; and the Chemistry Club, a student affiliate chapter of the American Chemical Society. All chemistry majors are encouraged to join one and/or both of these groups. Activities include meetings, socials, tutoring, and hosting "illusion shows" and other fun activities. These organizations are great opportunities for you to network with your peers, organize study groups, and broaden your social opportunities at Virginia Tech.

Alpha Chi Sigma

AXE is a co-ed professional chemistry fraternity.

- <https://alphachisigma.wixsite.com/axsvt>

Chemistry Club

The Chemistry Club is affiliated with the American Chemical Society (SAACS).

- <https://chem.vt.edu/undergraduate/student-organizations.html>

Your Well-Being and Work-Life Balance

The Chemistry Department believes strongly in educating, advising, and supporting the whole student in view of Hokie Wellness, which strives to educate and empower every Hokie to take an active and engaging day-to-day approach to their wellness in order to enjoy a long, healthful, and purpose-filled life. Your advisor can direct you to resources on campus that can help you with individual needs. Many of the resources described here are also embedded within Virginia Tech's new Residential Well-Being program.

- University or "Cook" Counseling Center (UCC): short-term individual, couples, and group counseling for a variety of concerns. Students come in for counseling to help them with issues such as stress, depression, anxiety, loneliness, sexual concerns, academic motivation, and relationship problems.
 - Website: <https://www.ucc.vt.edu>
 - Daytime phone: 540-231-6557
 - Emergency phone: 540-231-6444 or dial 911
- Public Health Information: Virginia Tech maintains an information-rich website on many aspects of Public Health, with sections for COVID-19, cold & flu, monkeypox, norovirus, sexual health, and substance misuse. Of course, many of these areas are advised and maintained by the staff at UCC.
 - Website: <https://www.vt.edu/public-health.html>
- Student Success Center: free academic support – such as tutoring and a wide variety of seminars and information sessions (including seminars on time management, honing test-taking and note-taking skills, and how to stay focused through the semester) – to undergraduate students.
 - Website: <https://www.studentsuccess.vt.edu>
- Virginia Tech Police Department: The Virginia Tech Police Department is nationally accredited by the Commission on Accreditation for Law Enforcement Agencies. VTPD strives to enhance the safety and quality of life for students, faculty, staff and visitors through effective law enforcement and proactive crime prevention in partnership with the university community. Several programs are offered by the department, free of charge, to VT students, including Student's Police Academy, Self-Defense/Rape Aggression Defense System course, and VT C- CERT (Campus Community Emergency Response Team) training. Please visit the department's website (www.police.vt.edu) for more information. The police department also sponsors a nighttime campus safety escort service known as Safe Ride. Safe Ride operates from dusk until dawn and provides transportation or a walking escort upon request.
 - Website: <https://www.police.vt.edu>
 - Phone for Safe Ride: 540-231-SAFE
- Dean of Students Office: If you have an extended or serious illness, a death in your family, or other significant personal difficulty that will cause you to miss a significant number of classes (or any labs), or from meeting course deadlines, notify the Dean of Students (website = <http://dos.vt.edu>, email = dos@vt.edu) of your issue. They will manage your personal verification and private documentation such as notes from doctors, funeral directors, etc., which instructors normally do not wish to handle. The Dean of Students will also notify, via your Academic Dean, all of your course instructors of your situation with a date range for your 'verified absence.' This endorsement from the Dean of Students does *not* guarantee extensions on deadlines, but it *allows* an instructor to help you with less concern about unfairness toward others. There are practical limits on academic accommodations and that some situations are severe enough to warrant other forms of assistance such as course withdrawal or academic relief, which are described elsewhere in this Handbook.

Inclusion and Diversity

- The Chemistry Department is committed to providing an inclusive educational and working space for all of its students and employees.
- If there are aspects of your program that prevent you from learning or exclude you, please let your advisor know as soon as possible. We can set up a private meeting (in person or Zoom) and work together to develop strategies to meet both your needs and the requirements of program, and we can advocate for you with other individuals including your course instructors or campus administrators.
- All members of the Advising Team will honor your request to address you by your chosen name or personal pronoun. Please advise us so that we may make appropriate changes to our records.
- If you are a veteran or active-duty military personnel with special circumstances (e.g., upcoming deployments, drill requirements, disabilities) please know that we want to accommodate your special circumstances. You will find that course instructors are quite accommodating toward the needs of veterans and active-duty military personnel.
- In the event an instructor or advisor suspects you need additional support, they will often express their concerns and remind you of resources that might be helpful to you. It is not their intention to pry into the details of what might be bothering you, but simply to let you know we are concerned and that help, if needed, is available.
- Any student who has difficulty affording groceries, accessing sufficient food to eat every day, or who lacks a safe and stable place to live, or who lacks child care, and who believes this may affect your performance in this course, is urged to contact the Dean of Students office for support at 540-231-3787 (dos@vt.edu) or complete an interest form to participate in The Market at Virginia Tech. The Dean of Students, through [The Market at Virginia Tech](#), offers food options and other resources. There is also a [Student Emergency Fund](#) program. If you are comfortable in doing so, please notify your professor or departmental advisor of your situation. This will enable them to provide any resources to which they may have access.
- We respect and support your decision to honor your cultural and religious holidays. If you have religious or cultural observances that coincide with your classes, please notify your instructor through email at least one week before the date that is in conflict. Otherwise, they will reasonably assume that you plan to attend all class meetings.
- Your advising team wants you to feel able to share your life experiences in our advising conversations. We want you to trust that we will keep any information you share private. Please be aware that we do have a mandatory reporting responsibility related to our roles as members of the faculty or staff. This means we are required to share information regarding sexual misconduct or information about a crime that may have occurred on campus with the university Title IX Coordinator.

Disability and Other Special Needs

Virginia Tech welcomes students with disabilities into the University's educational programs and promotes efforts to provide equal access and a culture of inclusion without altering the essential elements of coursework. If you anticipate or experience academic barriers that may be due to disability, including but not limited to ADHD, chronic or temporary medical conditions, deaf or hard of hearing, learning disability, mental health, or vision impairment, please contact the Services for Students with Disabilities (SSD) office (540-231-3788, ssd@vt.edu, or visit ssd.vt.edu).

Conflict and Discrimination

The Chemistry Department promotes and supports an educational and working space that is free of conflict and discrimination. This page describes resources for navigating conflict and for reporting discrimination.

If you are unsure who to talk to, the University Ombudsperson provides a safe place for you to be heard and engage in a confidential and informal conversation to bring clarity to your situation and plan a path forward. Note that The Ombudsperson is **not** a mandatory reporter (see boxed definition at the bottom of the page*). Email Ombuds@vt.edu or call 540-231-3125 to set up an appointment. You should also feel free to talk with other undergraduate students about how similar problems have been handled previously.

Do you want to file a formal report?

NO or NOT YET – You can remain anonymous, *depending on the circumstances*

Departmental issue or conflict → Talk to a fellow student or visit Dean of Students (dos.vt.edu).

Bias incident → Report bias at [Express-A-Concern](#) (a service of the Dean of Students)

Personal problem or conflict → Several resources are available:

Dean of Students (dos.vt.edu) or the University Ombudsperson (ombuds@vt.edu)

Women's Center (womenscenter.vt.edu) or University Counseling Center (ucc.vt.edu)

Conflict Resolution (oea.vt.edu)

Cultural and Community Centers (ccc.vt.edu)

Harassment or Discrimination (for this category, mandatory reporting requirements will apply*)

Dean of Students (dos.vt.edu) or the University Ombudsperson (ombuds@vt.edu)

Women's Center (womenscenter.vt.edu) or University Counseling Center (ucc.vt.edu)

Office for Equity and Accessibility (equityandaccess@vt.edu)

Do you want to file a formal report?

YES – **Mandatory reporting* will apply (see box at the bottom of the page)**

Departmental issue or conflict → You may speak with a trusted faculty member; or the Department Head (Amanda Morris); or the Undergraduate Program Director (Paul Deck).* If action is required by the departmental administration, then final action will be taken by the Department Head.

Personal problem or conflict → You may speak with the Undergraduate Program Director (Paul Deck) or any other trusted faculty member.*

Harassment or Discrimination → Contact the Office for Equity and Accessibility at 540-231-2010 or by email at equityandaccess@vt.edu. The OEA will respond to the report and manage all aspects of any appropriate investigative and disciplinary processes.

***Mandatory Reporting.** University [Policy 1025](#) and [Policy 1026](#) require VT faculty, staff, and oftentimes graduate students with employment responsibilities, to report incidents of discrimination or harassment to the Office for Equity and Accessibility. This responsibility to report applies fully, *even if the person raising the concern asks that no action be taken or requests confidentiality*. For more information, see the policies or contact OEA at equityandaccess@vt.edu.

Course Descriptions

Pathways Concept numbers are defined on p. 5. [H] indicates that an Honors version of the course exists. Honors versions of courses have the same prerequisites and co-requisites.

CHEM 1004 - First Year Experience in Chemistry (1 credit)

Orientation to the Chemistry Department and to the discipline of chemistry for chemistry majors and for individuals considering CHEM as a major, including transfer students. Resources for success, both generally as a college student and specifically as a chemistry major. Opportunities for mentoring, individual research and community involvement across the university and within the Chemistry Department. Exploration of career pathways for chemistry majors. Interconnections among professional practice, disciplinary progress, accepted standards for ethical use of information, principles of diversity and inclusion, and individual or personal value systems. Scientific communication, professional networking, and chemistry in the public eye.

CHEM 1014 - Calculations in Chemistry (3 credits)

Mathematical problem solving skills required for success in general chemistry. Manipulation of symbolic algebraic formulas. Dimensional analysis and narrative mathematical exercises. Application of problem solving techniques to chemical processes and reactions. Generation and interpretation of graphs using computer software. Elementary features of atoms, molecules, and the periodic table of the elements. Molar quantities, chemical nomenclature, reaction stoichiometry, and introductory solution chemistry.

CHEM 1015 - Chemistry in Context (3 credits) (P4)

Survey of chemistry across areas of specialization for students enrolled in curricula other than science and engineering. History and fundamental concepts and theories of chemistry, including the consequences of changes in parameters on chemical systems. Impact of chemistry in the context of areas of public concern and policy, including best practices for sustainability, rational decision-making, ethical use of scientific information, product and process stewardship. Chemistry as a basis for decision-making in the context of individual values and beliefs, and the roles of values and beliefs in the progress of chemistry as a human endeavor. The foregoing to be based on the concepts of chemistry as follows: 1015: Periodicity and atomic structure; nuclear chemistry; chemical bonding and reactivity; organic chemistry, polymer chemistry, and medicinal chemistry. 1016: Chemical stoichiometry including conservation of matter and energy; acid-base and oxidation-reduction chemistry of solutions; stoichiometry and thermodynamics, agricultural and environmental chemistry, chemistry of household and personal care products

CHEM 1016 - Chemistry in Context (3 credits) (P4)

Survey of chemistry across areas of specialization for students enrolled in curricula other than science and engineering. History and fundamental concepts and theories of chemistry, including the consequences of changes in parameters on chemical systems. Impact of chemistry in the context of areas of public concern and policy, including best practices for sustainability, rational decision-making, ethical use of scientific information, product and process stewardship. Chemistry as a basis for decision-making in the context of individual values and beliefs, and the roles of values and beliefs in the progress of chemistry as a human endeavor. The foregoing to be based on the concepts of chemistry as follows: 1015: Periodicity and atomic structure; nuclear chemistry; chemical bonding and reactivity; organic chemistry, polymer chemistry, and medicinal chemistry. 1016: Chemical stoichiometry including conservation of matter and energy; acid-base and oxidation-reduction chemistry of solutions; stoichiometry and thermodynamics, agricultural and environmental chemistry, chemistry of household and personal care products

CHEM 1025 - Introduction to Chemistry Laboratory (1 credit) (P4)

Virtual laboratory exercises and reading and writing assignments designed to accompany 1015 and 1016, as applicable. Illustrates and elaborates on principles addressed in lecture, including history and fundamental concepts, theories, contexts, with an emphasis on sustainability issues and ethical consequences of decision-making in chemistry. Students will identify foundational concepts in chemistry, enumerate parameters likely to influence the outcome of an experiment, analyze the ways that values and beliefs influence progress in the discipline and communicate chemical concepts to a lay audience.

CHEM 1026 - Introduction to Chemistry Laboratory (1 credit) (P4)

Virtual laboratory exercises and reading and writing assignments designed to accompany 1015 and 1016, as applicable. Illustrates and elaborates on principles addressed in lecture, including history and fundamental concepts, theories, contexts, with an emphasis on sustainability issues and ethical consequences of decision-making in chemistry. Students will identify foundational concepts in chemistry, enumerate parameters likely to influence the outcome of an experiment, analyze the ways that values and beliefs influence progress in the discipline and communicate chemical concepts to a lay audience.

CHEM 1034 - General Chemistry Recitation (1 credit)

A companion course for students needing supplemental help with mathematical and problem-solving skills required for CHEM 1035 General Chemistry. Manipulation of algebraic formulas. Application of problem-solving techniques to chemical processes and reactions. Quantitative methods applied to unit conversions, reaction yields, energy of reactions, and gas properties. Examination of atomic structure, periodicity, and molecular bonding. May not count towards degree requirements; consult advisor. Pass/Fail only.

- Co: CHEM 1035.

CHEM 1035 - General Chemistry (3 credits) (P4)

First chemistry course for students in science curricula. Applications of reasoning in the natural sciences using chemical laws in an applied context and in the student's own discipline. Overview of the universal aspects of chemistry and of application of chemistry to address global challenges. 1035: Problem-solving, elements and periodic table, stoichiometry of chemical reactions, gas phase of matter, energy flow and chemical change, atomic structure, and theories of chemical bonding. 1036: Kinetics, equilibrium, thermodynamics, electrochemistry, transition elements, nuclear chemistry. (Duplicates 1015-1016.)

- Pre: CHEM 1014 or or MATH 1025 or MATH 1536 or MATH 1225 or MATH 1214 or ALEKS 61.
- Co: MATH 1025 or MATH 1225.

CHEM 1036 - General Chemistry (3 credits) (P4)

First chemistry course for students in science curricula. Applications of reasoning in the natural sciences using chemical laws in an applied context and in the student's own discipline. Overview of the universal aspects of chemistry and of application of chemistry to address global challenges. 1035: Problem-solving, elements and periodic table, stoichiometry of chemical reactions, gas phase of matter, energy flow and chemical change, atomic structure, and theories of chemical bonding. 1036: Kinetics, equilibrium, thermodynamics, electrochemistry, transition elements, nuclear chemistry. (Duplicates 1015-1016.)

- Pre: CHEM 1035 or 1055 or 1055H.
- Co: MATH 1025 or MATH 1225.

CHEM 1045 - General Chemistry Laboratory (1 credit) (P4)

Hands-on, real-world activities that illustrate and elaborate on concepts taught in general chemistry lecture (1035), including acids and bases, heat capacity, ideal gases, states of matter, concentration, mixtures, energy flow and spontaneity in processes, equilibrium, kinetics, colligative properties, and electrochemistry. Use of instrumentation to analyze water and soil contaminants, biofuel mixtures, nanoparticles, and polymer properties. Laboratory safety, chemical hygiene, hazard mitigation, waste management, and the influence of procedure on experimental outcomes. Global challenges, including recycling and sustainable energy sources, water resource management, global warming, and environmentally friendly reagents in chemical contexts. Use of computers in data analysis, collaboration, and report-writing.

- Pre: CHEM 1014 or MATH 1014 or MATH 1025 or MATH 1536 or MATH 1225 or MATH 1214.
- Co: CHEM 1035.

CHEM 1046 - General Chemistry Laboratory (1 credit) (P4)

Hands-on, real-world activities that illustrate and elaborate on concepts taught in general chemistry lecture (1036), including acids and bases, heat capacity, ideal gases, states of matter, concentration, mixtures, energy flow and spontaneity in processes, equilibrium, kinetics, colligative properties, and electrochemistry. Use of instrumentation to analyze water and soil contaminants, biofuel mixtures, nanoparticles, and polymer properties. Laboratory safety, chemical hygiene, hazard mitigation, waste management, and the influence of procedure on experimental outcomes. Global challenges, including recycling and sustainable energy sources, water resource management, global warming, and environmentally friendly reagents in chemical contexts. Use of computers in data analysis, collaboration, and report-writing.

- Co: CHEM 1036.

CHEM 1055 - General Chemistry for Chemistry Majors (4 credits) [H]

In depth treatment of chemical bonding, thermodynamics, chemical equilibrium, reaction kinetics, descriptive chemistry of the elements, acid-base chemistry, chemistry of gases, liquids and solids, and other topics. This class is restricted to chemistry and biochemistry majors. Other students may request consent of instructor.

- Pre: CHEM 1014 or MATH 1014 or MATH 1025 or MATH 1225 or MATH 1214 or ALEKS 61.
- Co: CHEM 1065 and (MATH 1025 or MATH 1225).

CHEM 1056 - General Chemistry for Chemistry Majors (4 credits) [H]

In depth treatment of chemical bonding, thermodynamics, chemical equilibrium, reaction kinetics, descriptive chemistry of the elements, acid-base chemistry, chemistry of gases, liquids and solids, and other topics. This class is restricted to chemistry and biochemistry majors. Other students may request consent of instructor.

- Pre: CHEM 1055
- Co: CHEM 1066

CHEM 1065 - General Chemistry for Chemistry Majors Lab (1 credit)

Accompanies 1055-1056. Selected experiments illustrate principles taught in lecture. This class is restricted to chemistry and biochemistry majors. Other students may request consent of instructor.

- Pre: CHEM 1014 or MATH 1014 or MATH 1025 or MATH 1536 or MATH 1225 or MATH 1214
- Co: CHEM 1055

CHEM 1066 - General Chemistry for Chemistry Majors Lab (1 credit)

Accompanies CHEM 1056. Selected experiments illustrate principles taught in lecture. This class is restricted to chemistry and biochemistry majors. Other students may request consent of instructor.

- Co: CHEM 1056

CHEM 2114 - Analytical Chemistry (3 credits)

A first course in analytical chemistry. Topics covered include volumetric and gravimetric analysis, and elementary spectroscopy. This analytical chemistry course is required for degree programs in environmental science (ENSC) and geosciences (geochemistry option).

- Pre: CHEM 1036 or CHEM 1056 or CHEM 1056H
- Co: CHEM 2124

CHEM 2124 - Analytical Chemistry Laboratory Techniques and Practice (1 credit)

Practical introduction to wet methods of quantitative chemical analysis based on fundamental chemical principles.

- Pre: CHEM 1045 or CHEM 1066
- Co: CHEM 2114

CHEM 2154 - Analytical Chemistry for Chemistry Majors (4 credits)

A one-semester course in analytical chemistry emphasizing the principles of equilibrium with examples from acid-base, complexation, solubility, and redox chemistry. The course also introduces the principles of spectroscopic, electrochemical, and chromatographic instrumentation.

- Pre: CHEM 1036 or CHEM 1056 or CHEM 1056H
- Co: CHEM 2164

CHEM 2164 - Analytical Chemistry for Chemistry Majors Lab (1 credit)

A one-semester laboratory course in analytical chemistry that provides practical training in wet chemical methods, atomic and molecular spectroscopy, electrochemistry, and separations.

- Pre: CHEM 1046 or CHEM 1066
- Co: CHEM 2154

CHEM 2424 - Descriptive Inorganic Chemistry (3 credits)

Application of fundamental principles in a systematic study of bonding and reactivity of the elements and their compounds.

- Pre: CHEM 1036 or CHEM 1056

CHEM 2514 - Survey of Organic Chemistry (3 credits)

Short course in fundamentals of organic chemistry with emphasis on nomenclature, isomerism, and properties of organic compounds. Compounds of importance to biology and biochemistry stressed. (Prior credit for 2535 precludes credit for this course.) One year of Chemistry required.

- Pre: (CHEM 1035 or CHEM 1055 or CHEM 1055H) and (CHEM 1036 or CHEM 1056 or CHEM 1056H)

CHEM 2535 - Organic Chemistry (3 credits)

Structure, stereochemistry, reactions, and synthesis of organic compounds.

- Pre: (CHEM 1036 or CHEM 1056 or CHEM 1056H or ISC 1106 or ISC 1106H)

CHEM 2536 - Organic Chemistry (3 credits)

Structure, stereochemistry, reactions, and synthesis of organic compounds. Pre: One year of chemistry, including lab.

- Pre: CHEM 2535 or CHEM 2565 or CHEM 2565H

CHEM 2545 - Organic Chemistry Laboratory (1 credit)

The laboratory accompanies lectures in organic chemistry 2535.

- Pre: CHEM 1046 or CHEM 1066 or ISC 1116
- Co: CHEM 2535 or CHEM 2565

CHEM 2546 - Organic Chemistry Laboratory (1 credit)

The laboratory accompanies lectures in organic chemistry 2536.

- Pre: CHEM 2545
- Co: CHEM 2536

CHEM 2555 - Organic Synthesis and Techniques Lab (2 credits)

Synthesis and characterization of organic compounds using modern laboratory techniques.

- Pre: CHEM 1045 or CHEM 1065
- Co: CHEM 2565

CHEM 2556 - Organic Synthesis and Techniques Lab (2 credits)

Synthesis and characterization of organic compounds using modern laboratory techniques.

- Pre: CHEM 2555
- Co: CHEM 2556

CHEM 2564 - Problem-Solving in Organic Chemistry (1 credit)

Writing organic reaction mechanisms; rationalizing and predicting organic reaction outcomes; selecting reagents for organic reactions; designing syntheses of several elementary steps; visualizing molecular stereochemistry.

- Co: CHEM 2565

CHEM 2565 - Principles of Organic Chemistry (3 credits)

Organic chemistry for chemistry majors. Structure and reactions of organic compounds, with emphasis on fundamental principles, theories, synthesis, and reaction mechanisms. The subject matter partially duplicates that of 2535-2536; no credit will be given for the duplicated courses.

- Pre: CHEM 1035 or CHEM 1055 or CHEM 1055H

CHEM 2566 - Principles of Organic Chemistry (3 credits)

Organic chemistry for chemistry majors. Structure and reactions of organic compounds, with emphasis on fundamental principles, theories, synthesis, and reaction mechanisms. The subject matter partially duplicates that of 2535-2536; no credit will be given for the duplicated courses.

- Co: CHEM 2565

CHEM 3615 - Physical Chemistry (3 credits) [H]

Principles of thermodynamics, kinetics, and quantum mechanics applied to chemical equilibria, reactivity, and structure. Partly duplicates 4615, cannot receive credit for both 3615 and 4615.

- Pre: (CHEM 1035 or CHEM 1055 or CHEM 1055H) and (CHEM 1036 or CHEM 1056 or CHEM 1056H) and PHYS 2306 and (MATH 2204 or MATH 2204H or MATH 2224).

CHEM 3616 - Physical Chemistry (3 credits) [H]

Principles of thermodynamics, kinetics, and quantum mechanics applied to chemical equilibria, reactivity, and structure. Partly duplicates 4616, cannot receive credit for both 3616 and 4616.

- Pre: (CHEM 3165 or CHEM 3615H) and MATH 2214

CHEM 3625 - Physical Chemistry Laboratory (1 credit)

Laboratory study of selected physico-chemical principles and methods. Data acquisition, data analysis, and report writing are stressed.

- Pre: CHEM 3615 or CHEM 3615H or CHEM 4615 or CHE 2164

CHEM 3626 - Physical Chemistry Laboratory (1 credit)

Laboratory study of selected physico-chemical principles and methods. Data acquisition, data analysis, and report writing are stressed. I

- Pre: (CHEM 3616 or CHEM 3616H or CHEM 4616) and CHEM 3625 and CHEM 4014

CHEM 3684 (PHYS 3684) - Quantum Software I (2 credits)

Organization of quantum information (assemblies of bits) for quantum-computing applications in chemistry, physics, biology, and computer science. Numerical methods for quantum software, emphasizing spin lattices and simulations such as quantum games. Best practices for programming, including techniques for quantum-coding (in Python or Julia), structuring a software product for quantum-computational science use, version control, and cloud-based documentation and code-sharing (via Github). Classical/quantum translation.

- Pre: MATH 2114 or MATH 2114H or MATH 3144
- Co: PHYS 3684

CHEM 3900 - Bridge Experience (0 credits)

Application of academic knowledge and skills to in a work-based experience aligned with post-graduation goals using research-based learning processes. Satisfactory completion of work-based experience often in the form of internship, undergraduate research, co-op, or study abroad; self-evaluation; reflection; and showcase of learning.

- Pre: Departmental approval of 3900 plan.

CHEM 4014 - Survey of Chemical Literature (1 credit)

Use of the chemical literature as an aid to professional activities

- Pre: Junior standing in the major.

CHEM 4074 (MSE 4544) - Laboratory in Polymer Science (2 credits)

Experimental techniques used in the synthesis of various linear polymers, copolymers, and crosslinked networks. Determination of polymer molecular weights and molecular weight distribution. Methods used in the thermal, mechanical, and morphological characterization of polymeric systems.

- Pre: CHEM 4534 and CHEM 3625 and (CHEM 3615 or CHE 2164).

CHEM 4114 - Instrumental Analysis (3 credits) [H]

Principles of instrumental methods including data analysis, phase equilibrium, spectroscopy, and electrochemistry. Applications of modern instrumentation to chemical analyses using chromatography, electrophoresis, atomic and molecular spectroscopy, potentiometry, and voltammetry. Note: Graduate students will not be expected to take the corequisite lab 4124.

- Pre: CHEM 2154

CHEM 4124 - Instrumental Analysis Laboratory (1 credit)

Hands-on experience with modern instrumental methods of analysis. Experiments use spectroscopy, electrochemistry, and separations.

- Co: CHEM 4114

CHEM 4404 - Physical Inorganic Chemistry (3 credits)

A study of spectroscopic, bonding, and structural properties of inorganic compounds.

- Pre: (CHEM 3616 or CHEM 3616H) and CHEM 2424

CHEM 4414 - Inorganic Chemistry Lab (2 credits)

Synthesis and characterization of inorganic compounds using modern laboratory techniques.

- Pre: CHEM 2424, (CHEM 3616 or CHEM 3616H), and CHEM 4404
- Co: CHEM 3616 and CHEM 4424

CHEM 4424 (SBIO 4424) - Polysaccharide Chemistry (3 credits)

Structure, properties, and applications of natural polysaccharides. Natural sources and methods of isolation. Synthetic chemistry and important polysaccharide derivatives. Relation of structure and properties to performance in critical applications including pharmaceuticals, coatings, plastics, rheology control, and films. Conversion by chemical and biochemical methods of polysaccharide biomass to fuels and materials.

- Pre: CHEM 2536 or CHEM 2566

CHEM 4434 - Organometallic Chemistry (3 credits)

Synthesis, structure, properties, and reactivity patterns of main-group and transitionmetal organometallic compounds. Applications of organometallic compounds in chemical synthesis and catalysis.

- Pre: CHEM 2424 and CHEM 2566 and CHEM 4404

CHEM 4444 - Bioinorganic Chemistry (3 credits)

Principles underpinning the study of metal ions in biological systems. Review of basic coordination chemistry. Evolution of the distribution of metal ions in biology. Uptake of metal ions from the environment into living organisms. Regulation of metal ion concentrations in cells. Central functions of metal ions in biological systems including modulation of structure, electron transfer reactions, substrate binding and activation, and selective transfer of atoms and groups. Roles of biopolymers in the binding, regulation, and function of metal ions. Physical methods of analysis relevant to bioinorganic chemical research questions. Senior standing.

- Pre: (CHEM 2566 or BCHM 4115) and BIOL 1105 and BIOL 1106

CHEM 4514 - Green Chemistry (3 credits)

Sustainability, waste prevention, conservation of energy resources, avoidance of toxins, pollutants, and hazards in chemical processes and products. Life-cycle analysis applied to case studies involving process development and product stewardship. Applications in chemical industry, process and product design, and public policy.

- Pre: CHEM 2536 or CHEM 2566

CHEM 4524 - Identification of Organic Compounds (3 credits)

Structure determination of organic compounds by spectroscopic methods, with an emphasis on mass spectrometry and nuclear magnetic resonance. Course will emphasize problem-solving skills.

- Pre: (CHEM 2536 or CHEM 2566) and (CHEM 3616 or CHEM 3616H or CHEM 4616)

CHEM 4534 - Organic Chemistry of Polymers (3 credits)

Structure, synthesis, and basic characteristics of the major classes of polymerization reactions including step-growth (condensation) and chain growth (addition), free radical, and ionic mechanisms.

- Pre: CHEM 2536 or CHEM 2566

CHEM 4544 - Medicinal Chemistry Capstone Laboratory (2 credits)

Laboratory experience tracing a standard pathway that potential drug targets follow in many medicinal chemistry laboratories. Synthesis of potential drug compounds and verification of their purity and structural identity primarily using mass spectrometry and nuclear magnetic resonance (NMR) spectroscopy. Optimization of conditions for a biochemical assay and verification of its reproducibility. Use of an optimized assay to measure the potency of potential drug compounds to achieve a desired biochemical effect. Application of structure-activity relationships to propose new chemical structures that might show further improvements in potency. Best practices in laboratory safety, chemical hygiene, note-keeping, and professional report-writing. Senior standing.

- Pre: CHEM 4584 and BIOL 1105 and BIOL 1106

CHEM 4554 - Drug Chemistry (3 credits)

Structure, synthesis, and physiological effects of major classes of pharmaceutical agents including CNS depressants and stimulants, analgesics, anesthetics, cardiovascular agents, chemotherapeutic drugs, and oral contraceptives.

- Pre: CHEM 2536 or CHEM 2566

CHEM 4584 - Bioorganic Chemistry (3 credits)

The organic chemistry underlying the structure and properties of amino acids, peptides, and nucleic acids. Mechanisms of enzyme catalysis and coenzyme-mediated reactions. Mechanisms and thermodynamics of catabolism and anabolism of fats, carbohydrates, and proteins, and of other key biological reactions. Principles of solid-phase synthesis applied to peptides and nucleic acids. Biosynthesis of lipids, sugars, and terpenoids.

- Pre: CHEM 2536 or CHEM 2566

CHEM 4615 - Physical Chemistry for the Life Sciences (3 credits)

Principles of thermodynamics, chemical kinetics, and chemical bonding for students in the life sciences. Laws and applications of thermodynamics. Partly duplicates 3615, cannot receive credit for 3615 and 4615.

- Pre: (CHEM 1036 or CHEM 1056 or CHEM 1056H) and (MATH 1026 or MATH 1226) and (PHYS 2206 and PHYS 2306)

CHEM 4616 - Physical Chemistry for the Life Sciences (3 credits)

Principles of thermodynamics, chemical kinetics, and chemical bonding for students in the life sciences. Chemical kinetics and chemical bonding including spectroscopy. Partly duplicates 3616, cannot receive credit for both 3616 and 4616.

- Pre: (CHEM 1036 or CHEM 1056 or CHEM 1056H) and (MATH 1026 or MATH 1226) and (PHYS 2206 and PHYS 2306)

CHEM 4624 - Materials Chemistry in Energy Sciences (3 credits)

Fundamental principles of solid-state materials chemistry in energy sciences. Thermodynamics and kinetics of electron and ion transport in solid materials. Application of electrochemical and photochemical principles to batteries, fuel cells, solar cells, and other energy devices. Analytical tools and characterization methods for elucidating mechanisms within electrochemical and photoelectrochemical cells, with an emphasis on using electrochemical principles to evaluate battery chemistry. Solid-liquid interfacial mechanisms in energy devices. Critical analysis of relevant primary literature. Formulation of hypotheses and experimental design for improving device performance. Pre: Senior standing.

- Pre: CHEM 3615 or CHEM 4615

CHEM 4634 - Polymer and Surface Chemistry (3 credits)

Physical chemical fundamentals of polymers and surfaces including adhesives and sealants.

- Pre: CHEM 3615 or CHEM 4615

CHEM 4684 (PHYS 4684) - Quantum Software II (1 credit)

Modern software collaboration techniques and tools including collaborative code repositories and cloud-based documentation. Application of structure and version control to software and documentation. Developing code with industry-standard quantum-software modules. Hands-on scientific coding for quantum problems. Project management skills including proposal development and technical presentation delivery.

- Pre: CHEM 3684 or PHYS 3684

CHEM 4734 (CSES 4734, ENSE 4734) - Environmental Soil Chemistry (3 credits)

Chemistry of inorganic and organic soil components with emphasis on environmental significance of soil solution-solid phase equilibria, sorption phenomena, ion exchange processes, reaction kinetics, redox reactions, and acidity and salinity processes.

- Pre: (CSES 3114 or ENSC 3114 or GEOS 3614) and (CSES 3124 or ENSC 3124 or GEOS 3624) and (CHEM 2514 or CHEM 2535) and CHEM 2114 and (MATH 1026 or MATH 1226).

CHEM 2964 and CHEM 4964 - Field Study (1-19 credits) This course number is never used.

CHEM 2974 and CHEM 4974 Independent Study (1-19 credits) This variable-credit elective is used for faculty-directed studies of special topics in chemistry on an individual basis. Whether a faculty member will instruct you through an “independent study” course, and the “level” of the course (2000 or 4000) is entirely at the faculty member’s discretion. Topics for independent study have included advanced techniques in chemical instrumentation such as GCMS, LCMS, or NMR. Independent Study may be awarded honors credit (2974H or 4974H).

CHEM 2984 and CHEM 3984 and CHEM 4984 Special Study (1-19 credits) Special study courses are usually new courses that are being piloted before starting the formal process of proposing a new course for the catalog. A special study might also be an unusual topic in chemistry that is being taught by a visiting faculty member, or it might be a course that a regular faculty member is teaching on a one-time basis. Each special study will be named “TS” followed by the topic of the course. Special study courses can be at either the 2000 level or the 4000 level.

CHEM 4994 - Undergraduate Research (1-19 credits) [H] Please see p. 16 of this Handbook.