Chemistry

COURSES AVAILABLE TO FIRST-YEAR STUDENTS:

- Chem 111a, Chem 113a or Chem 115a (Fall): these courses satisfy the requirements for the Chemistry major and for the pre-health track, as described in more detail below. Completion of the Chemistry Placement test is required to take any of these courses (see below for further information).

- Chem 112b or Chem 114b (Spring): see above. For pre-health, etc. requirements students typically take one course (111/113/115) in the fall and one course (112/114) in the spring.

I. Introductory 100-level Chemistry Courses That Lead to the Major and Satisfy the Pre-Medical Requirement (Chem 111a, 113a, 115a, 112b and 114b).

Students considering a Chemistry major, those who wish to fulfill pre-med/health requirements, and most students interested in a Biology major should enroll in two Chemistry courses during their first year at Haverford: Chem 111a, 113a or 115a in the fall, and either Chem 112b or 114b in the spring. The first year curriculum at Haverford differs greatly from advanced placement or summer school chemistry courses. As such, students are not allowed to place directly into 200-level organic chemistry.

Chem 111a/113a and/or 112b/114b are also appropriate for motivated students planning to major in other disciplines but who desire a laboratory-based rigorous introduction to the discipline of Chemistry. Students interested in Environmental Studies who desire to take just a single Chemistry course are advised to take Chem 112b/114b during the spring semester.

All students in any of the above categories must take the chemistry placement exam. We ask the UCA’s and faculty advisors to please remind advisees who have a possible interest in chemistry or biology or pre-med/health and who did not take the chemistry placement questionnaire on-line over the summer to do so immediately when they arrive on campus, and then email the Chemistry department chair (clonderg@haverford.edu for fall 2018). The form can be found at http://www.haverford.edu/chem/dept/placement/exam.php.

The three placement options for first-year students are as follows:
**Chem 111a Chemical Structure and Bonding section 1 (MWF 9:30-10:30) and section 2 (MWF 11:30-12:30)** are designed for students with an average preparation in high school chemistry. Both sections are taught by Prof. Rob Scarrow, who also leads an optional 1 hr recitation (although students do not need to register for recitation using Bionic, urge them to keep one of these two times open in their schedule). All Chem 111 students must also enroll in a weekly lab section taught by Dr. Kelly Matz. Times for all recitations and laboratory sections are listed on Bionic.

**Chem 113a Chemical Structure and Bonding** targets students with limited background in high school chemistry as assessed by departmental placement. This course consists of five 1 hr lectures (MWF 9:30 and TuTh 9:00), taught by Prof. Stephen Podowitz-Thomas, and one afternoon of lab, led by Dr. Kelly Matz. The extra classroom time allocated for Chem 113a allows for both review of fundamental high school level chemistry and extra problem solving opportunities in the classroom, in addition to the same content as covered in the lectures for sections 1 and 2 of Chem 111a.

**Chem 115a (Chemical Structure and Bonding with Inquiry Lab)** is a course targeting students with outstanding high school preparation. Students in this course will meet together for lectures with
students from Chem 111 (section 1: MWF 9:30; section 2: MWF 11:30), and are invited as well to attend with them the optional recitations (M 7 pm or Tu 10 am). All Chem 115 students must enroll in a weekly lab section taught by Prof. Jessica Stuart (M 1-4 pm or 7-10 pm), and in addition students will later schedule with Prof. Stuart a 45 minute group meeting every week to plan the following week’s experiments. In the inquiry lab associated with Chem 115, students become acquainted with modern methods of chemical structure analysis as they discover the identity of unknown chemical compounds via self-proposed experiments.

Chem 111a, 113a and 115a are followed in the Spring Semester by either Chem 112b or 114b (Chemical Dynamics). All students in Chem 112b and 114b take the same laboratory program, but Chem 114b is the intensive course, meeting 5 days per week. Students from Chem 113a (the intensive course) are given a recommendation to enroll in Chem 114b (the intensive course) or to transfer to either section of Chem 112b.

**Questions about Placement and Courses**
Advisees given a choice for a placement (i.e. in a borderline category), or others with questions about their placement recommendation should be urged to consult with a Chemistry faculty member at the Academic tea or during an office visit to determine the appropriate placement. Advisors should please note that new students with placements of “2” or “4” are strongly encouraged to discuss the appropriate course with the department.

**II. When to take Physics**
A year of physics is typically required for admission to medical school, and is also a requirement for the Biochemistry concentration as well as for an American Chemical Society certified Chemistry major. Students with a strong interest in chemistry and with a math placement of 118 or higher should consider taking a year of Chemistry (111a or 115a plus 112b) and a year of Physics (101/102 or 105 or 115/106) during their freshman year. This is also particularly important for students considering engineering options: such students might be best advised to enroll in three math/science courses during the fall semester. Partly because Math 118 is a prerequisite for Physics, students may need to take three math/science courses during one of their first two semesters.

**II.B. Resources for Students in Introductory Chemistry Classes**
Chemistry majors run a Chemistry Question Center several evenings each week, and a number of chemistry and biology majors work as Chemistry tutors in a program run by the Deans’ office. To receive individual tutoring, students should go to the Haverford College Deans’ web site, [http://www.haverford.edu/deans/OAR/website/](http://www.haverford.edu/deans/OAR/website/), where they will be directed to a chemistry tutor. Also, students are very strongly encouraged to take advantage of the office hours of their professor and attend the optional recitations.

**III. Non-Major Courses**
The Chemistry department generally offers one course per year (numbered 150-159) designed for students who are not interested in pursuing a science major and who have no college-level chemistry experience. The courses introduce chemical concepts and apply these to current issues of societal importance and to interesting applications of everyday life. The non-major courses satisfy the natural science distribution requirements, they are open to first year students, and do not have pre-requisites. However, they do not lead to the chemistry or biology majors, and they do not satisfy the chemistry requirements for medical school. (The chemistry department is not offering such a course in fall 2018.)
IV. Second year courses and courses required for pre-health students (not open to first-year students)

Chem 222a Organic Biological Chemistry (fall only)
Survey of organic chemistry reactions in an aqueous environment, highlighting transformations important for understanding the properties and reactivity of biomolecules in the cell. This course includes the basic organic pre-med competencies that will be tested in the MCAT’s starting in 2015. For most members of the class of 2018, this course will be the only organic chemistry course required for medical school.

Chem 225b Organic Reactions and Synthesis (spring only) This course explores organic reactions in mechanistic detail, and highlight their use in the syntheses of complex organic molecules. It will concentrate on functional group transformations and then delve into organometallic and enantioselective reactions for use in complex syntheses.

Students who have not enrolled in Chemistry 111/113/115 and 112/114 at Haverford (and perhaps took first-year chemistry elsewhere) are required to complete a set of review/catchup materials and take a readiness test before enrolling in Chem 222. First year students are not allowed to place out of Haverford’s first year chemistry courses, which are each substantially different from other “General Chemistry” or AP chemistry courses.

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This course will explore organic reactions in mechanistic detail, and highlight their use in the syntheses of complex organic molecules.  
The first two years of the Chemistry curriculum are summarized in the graphic below:  
**V. Research Opportunities.** The chemistry curriculum is aimed at training students to be independent and active research scientists at many levels. Each faculty member supervises student research throughout the academic year.  
**V.A. Senior Research.** Senior chemistry majors are required to conduct independent research in chemistry. Senior chemistry majors enroll in research for credit in both semesters, culminating in a senior seminar talk and a senior thesis.  
**V.B. Research before senior year.** Students become involved with our research laboratories earlier in their Haverford careers. Many summer research opportunities exist, funded through competitive internal fellowships and other institutional funds and also through faculty members’ research grants. It is also possible to conduct research in chemistry during the academic year for credit, either by enrolling in independent study (Chemistry 480) during a particular semester, or by enrolling in a “Chem 26x” course which is a full-year, half-credit commitment to a faculty mentor’s research laboratory.  
**VI. For Students interested in a Chemistry Major or Minor.**  
**VI.A. The Chemistry Major.** The major requirements are described in the catalog and on the web. Prospective majors complete the Introductory and Organic courses usually during their first two years. They then take 5.5 additional Chemistry courses, including physical chemistry, Superlab and advanced seminars during their last two years. They must also complete one semester of Math at a level of Math 118, but a higher level (121) is strongly recommended, and a year of either Biology or Physics. An additional course in physical chemistry, and a full year of *both* Physics and Biology are required for an American Chemical Society-certified degree (recommended for students wishing to pursue graduate study in chemistry). The department has approved several study-abroad and study-away programs with courses to substitute for required Chemistry courses. For further information, please consult [http://www.haverford.edu/chemistry/curriculum/studyabroad.php](http://www.haverford.edu/chemistry/curriculum/studyabroad.php).
VI.B. The Biochemistry Concentration. This may be elected with either a Biology or Chemistry major. The Chemistry major with Biochemistry concentration requires, in addition to 100/200 level chemistry courses, 4 or 4.5 Chemistry courses, 4 Biology courses, introductory Physics, and Calculus 118 or higher (http://www.haverford.edu/biochem-biophys/).

VI.C. The Scientific Computing Concentration. The concentration in scientific computing gives students an opportunity to explore the applications of computation to a scientific problem in their own major discipline. In the chemistry department, courses which can contribute to this concentration are Chem 304, Chem 305, and Chem 362; students are also encouraged to enroll in Chem B322 when offered. The department coordinator for this concentration is Joshua Schrier (http://cs.haverford.edu/curriculum/programs/SC-conc.html).

VI.D. The Chemistry Minor. Students who complete the Introductory and Organic Chemistry courses must complete one semester of Physical Chemistry and one additional semester of Chemistry to earn a Chemistry minor.

VI.E. The Environmental Interdisciplinary Studies Minor. This a Tri-Co program involving multiple disciplines. The director for this program is Helen White and additional information can be found at http://www.haverford.edu/environmentalstudies/.

VI.F. The 4+1 Engineering program with Penn. This new program is described at the following link: http://www.haverford.edu/engineering/upenn/. Students interested in this program should take special care to plan their first year courses and might be advised to take three math/science classes in one or both semesters of their first years. The Chemistry major + Master’s in Chemical and Biomolecular Engineering combination is particularly challenging both in terms of academic rigor and in scheduling sequence issues; students with strong interests in this option must take Chemistry (both semesters), Math (to level of 121) and a year of either Physics or language during their first year; a sample curriculum is available shortly at the website listed above.

The departmental web page (www.haverford.edu/chem) has additional information. Also, do not hesitate to contact the Chair (Alex Norquist, anorquis@haverford.edu, 610-896-2949) or any member of the chemistry department if you or your advisees have any questions.