Department of Chemistry and Biochemistry

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Web site: www.jmu.edu/chemistry/

Professors
D. Amenta, B. Augustine, T. DeVore, D. Downey, R. Foust, J. Gilje, G. MacDonald

Associate Professors
K. Caran, S. Lewis, K. Minbiole, D. Mohler, B. Reisner

Assistant Professors
B. Boardman, D. Havey, C. Hughey, K. Layman, V. Mariani, Y. Zhang

Lecturer
D. Warnaar

Mission Statement
The Department of Chemistry and Biochemistry offers the bachelor’s of science degree for a major in chemistry, preparing students for careers in chemistry, biochemistry, materials science, education and pre-professional areas including pharmacy, dentistry, medicine and veterinary medicine. American Chemical Society accredited programs are offered in chemistry, biochemistry, materials chemistry and chemical education. The department also offers concentrations in general chemistry and chemistry/business. Minors are offered in chemistry, biochemistry and molecular biology, and materials science. Courses for the non-chemistry major, who needs a basic understanding of chemical principles for either his/her chosen major or general education, are also provided by the department.

Career Opportunities
- Graduate school in chemistry, biochemistry or related areas (ACS Certified Degrees preferred)
- Professional employment as a chemist or biochemist (ACS Certified Degrees preferred)
- Professional school (Medical, Dental, Veterinary, Pharmacy, Business and Law)
- Chemical engineering
- Environmental science
- Forensic science
- Immunology
- Industrial hygiene
- Pharmaceutical chemistry
- Pharmacology
- Production supervision
- Quality control
- Research assistant
- Scientific writing
- Some forms of development work
- Technical library science
- Toxicology

Co-curricular Activities and Organizations
- American Chemical Society Student Affiliate Chapter
- Alpha Chi Sigma Professional Fraternity (Coed)
- Iota Sigma Pi

Degree and Major Requirements

Bachelor of Science in Chemistry

Degree Requirements

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education¹</td>
<td>41</td>
</tr>
<tr>
<td>Quantitative requirement (in addition to General Education)</td>
<td>3</td>
</tr>
<tr>
<td>Scientific Literacy requirement (in addition to General Education)</td>
<td>3-4</td>
</tr>
<tr>
<td>Major requirements (listed below) and electives</td>
<td>70-74</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
</tr>
</tbody>
</table>

¹ The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Major Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 131-132. General Chemistry I-II</td>
<td>6</td>
</tr>
<tr>
<td>CHEM 135L. Special General Chemistry Lab¹</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 136L. Special General Chemistry Lab¹</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 331. Physical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 341-342. Organic Chemistry Lecture</td>
<td>6</td>
</tr>
<tr>
<td>CHEM 351. Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 361. Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 370. Inorganic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 387L-388L. Integrated Inorganic/Organic Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 481-482. Literature and Seminar I-II</td>
<td>2</td>
</tr>
</tbody>
</table>

¹ CHEM131L and 132L may be substituted
Electives
The well-prepared student is encouraged to take as many of the additional departmental offerings as possible as electives with particular attention being given to junior and/or senior research projects.

Concentrations
Concentration I: American Chemical Society Accredited Programs
Required Courses for all ACS Certified Degrees
Core Chemistry Courses
CHEM 352. Instrumental Analysis
CHEM 352L. Instrumental Analysis Laboratory
CHEM 432. Physical Chemistry II
CHEM 438L. Physical Chemistry Laboratory

In addition, to ensure a sound background in physics and mathematics the following courses are required:
- MATH 235-236. Calculus I-II (or Math 231, 232, 236) 8-2
- PHYS 240-250. University Physics I-II 6
- PHYS 140L-150L. General Physics Laboratory 2

These courses may not be taken credit/no-credit.
Program-Specific Courses
ACS Certified Chemistry Major:
CHEM 300. Numerical Methods in Chemistry 1
CHEM 470. Inorganic Chemistry II 3
ACS Certified Biochemistry Major:
BIO 380. General Microbiology 4
BIO 480. Molecular Biology 4
CHEM 362. Biochemistry I 3
CHEM 366L. Biochemistry Laboratory 2

This program also meets the recommended undergraduate degree requirements of the American Society for Biochemistry and Molecular Biology for a major in biochemistry.
ACS Certified Materials Chemistry
CHEM 275. Introduction to Materials Science 3
CHEM 445. Polymer Chemistry 4
PHYS 381. Substituted for CHEM 438L/Materials Characterization Lab 3
MATH 237. Calculus III 4
MATH 238. Linear Algebra/Diff. Equations 4
ISAT 432. Materials Design & Selection 3

ACS Certified Degree in Chemical Education:
See "Licensure Programs."

Concentration II: General
Students following the general concentration must take, in addition to the core courses, the following:
CHEM 336L. Applied Physical Chemistry Laboratory 1
CHEM 352. Instrumental Analysis 3
CHEM 352L. Instrumental Analysis Laboratory 2

Choose one:
- MATH 235-236. Calculus I-II 8
- MATH 231-232. Calculus with Functions I-II and
- MATH 236. Calculus II 12
- PHYS 240-250. University Physics I-II 6
- PHYS 140L-150L. General Physics Laboratory 2
- Upper division chemistry elective 3

1 Students electing the general concentration are urged to take the same physics courses recommended under Concentration I; however, in special cases, PHYS 140-150 may be substituted with approval of the student’s department adviser.

Concentration III: Chemistry/Business
This program is designed for business-oriented chemistry students preparing for careers in patent law, technical sales, technical service and related areas. Students following the chemistry/business concentration must take, in addition to core courses, the following courses:
- COB 241. Financial Accounting 3
- COB 242. Managerial Accounting 3
- CHEM 336L. Applied Physical Chemistry Laboratory 1
- ECON 201. Principles of Economics (Micro) 3
- GECN 200. Introduction to Macroeconomics 3
- FIN 345. Managerial Finance 3
- MATH 231-232 or MATH 235. Introductory Calculus I-II 8 or 4
- MGT 305. Management and Organizational Behavior 3
- MKTG 380. Principles of Marketing 3
- PHYS 140-150. College Physics I-II 6
- PHYS 140L-150L. General Physics Laboratory 2
- Chemistry or approved science courses 5

Although business electives may be taken by students in this concentration, the total number of business credit hours may not exceed 27.

Recommended Schedule for Majors
First Year
- CHEM 131-132. General Chemistry I-II 6
- CHEM 135L-136L. Special General Chemistry Laboratory (or 131L-132L) 3
- MATH 235-236. Calculus I-II 8
- General Education courses or electives 14

Second Year
- CHEM 341-342. Organic Chemistry Lecture 6
- CHEM 370. Inorganic Chemistry I 3
- CHEM 387L-388L. Integrated Inorganic/Organic Laboratory 4
- PHYS 240-250. University Physics I-II 6
- PHYS 140L-150L. General Physics Laboratory 2
- General Education courses or electives 9

Third Year
- CHEM 331. Physical Chemistry I 3
- CHEM 351. Analytical Chemistry 4
- CHEM 352-352L. Instrumental Analysis with Laboratory 5
- CHEM 481-482. Literature and Seminar I-II 2
- General Education courses or electives 16

Fourth Year
- CHEM 361. Biochemistry I 3
- CHEM 432. Physical Chemistry II 3
- CHEM 438L. Physical Chemistry Laboratory 2
- General Education courses or electives 21

http://www.jmu.edu/catalog/10
Minor Requirements

Biochemistry and Molecular Biology Minor
See “Cross Disciplinary Programs” for the description of the cross disciplinary biochemistry and molecular biology minor.

Chemistry Minor
The requirements for a chemistry minor are 24 credit hours in chemistry, distributed as follows:
CHEM 131-132. General Chemistry I-II
CHEM 131L-132L. General Chemistry Laboratories
Choose from the following:
    CHEM 221-221L. Concepts of Organic Chemistry with Laboratory
    CHEM 341-342-346L. Organic Chemistry Lecture with Laboratory
CHEM 331. Physical Chemistry I
CHEM 351. Analytical Chemistry
Choose from the following:
    CHEM 336L. Applied Physical Chemistry Laboratory
    CHEM 432. Physical Chemistry II with
    CHEM 438L. Physical Chemistry Laboratory
An approved elective such as:
    CHEM 370. Inorganic Chemistry I
    CHEM 361. Biochemistry I
    Any 3 credit 300 or 400 level chemistry course
In order to complete this program, prerequisite courses in mathematics and physics are required.

Materials Science Minor
See “Cross Disciplinary Programs” for the description of the cross disciplinary material sciences minor.

Credit by Examination
The chemistry and biochemistry department offers credit by examination for CHEM 131 and 132, General Chemistry I-II. Students who want permission to take the examination must apply to the department head. Details regarding approval to take the examination and examination dates will be provided when the application is received.

Teaching Licensure
Students interested in becoming teachers must meet specific curriculum requirements in their major as part of the undergraduate academic degree. Chemistry majors must also complete a course in biology and a course in geology.
In addition to the general education and academic major requirements, chemistry majors desiring secondary teacher licensure must be admitted to teacher education, complete the pre-professional program in secondary education at the undergraduate level and the graduate level Master of Arts in Teaching degree.
It is critical that students seeking licensure consult regularly with both their education adviser and their major adviser to support their progression through the programs. For a full description of the program in secondary teaching, refer to the Department of Middle, Secondary and Mathematics Education, in addition to the College of Education/Professional Education Unit section of the catalog.