



Department of Chemistry

Phone (204) 727-9677

Fax (204) 728-7346

www.brandonu.ca/chemistry

DEPARTMENT OF CHEMISTRY

Brandon University

Faculty of Science

This document is meant as a planning guide only. Students are advised to consult with the Chair of the Department if they have specific questions about the program.

Mission Statement

To provide a high quality of education for students that will allow them to be active, productive, engaged members of society on local, national and international levels. Specifically the Chemistry program will prepare students for:

- 1) employment in any of the vast array of chemistry-related industries including: Agri-business; Biotechnology, Chemical, Environmental, Food Safety and Production, Geological, Medical research, Mining, Petroleum, and Pharmaceutical industries; and Quality Control-Quality Assurance sectors;
- 2) entry into a variety of second degree options, including Dentistry, Education, Engineering, Graduate school, Law, Medicine, Pharmacy and Veterinary Medicine; and
- 3) certification as a Professional Chemist.

Program Philosophy & Structure:

The American Chemical Society and the Canadian Society for Chemistry (CSC) conduct accreditation programs for North American (and international) Chemistry degree granting institutions. Both identify five sub-disciplines in the field of Chemistry: Analytical, Biological, Inorganic, Organic and Physical.

The Chemistry Department offers three degree options, a 3-year degree, a 4-year degree and a 4-year Honours degree. The 3-year degree provides a general introduction to Chemistry and a foundation in its five major sub-disciplines. This degree is generally only suitable for students subsequently enrolling in a second degree option through an articulation agreement, such as Education or Engineering. The 4-year degree and 4-year Honours degree are consistent with the accreditation requirements of CSC, and successful completion of either of these options will provide a Professional Chemist certification, qualifying the graduate to seek employment as a Chemist in a wide variety

270 18th Street

Brandon, Manitoba

Canada • R7A 6A9

of industrial fields. These options provide a depth of study and laboratory experience not possible in the 3-year degree and equip the student for a successful career as a Chemist.

The philosophy of the Chemistry department guides its programming and is stated as:

Provision of high quality undergraduate (and graduate) programming with a focus on individualized, accessible instruction from qualified, motivated, personable, dedicated Faculty. High quality programming provides both depth and breadth in courses, with a high percentage of laboratory contact hours that provide access to current accepted standards in chemical instrumentation. This requires that students have access to expertise in the five core areas of Chemistry: Analytical; Biological; Inorganic; Organic; and Physical; and dedicated hands-on instruction and experience in the use of current accepted standards of instrumentation.

Chemistry is a hierarchical and experiential discipline. During first year programming students receive introductory level instruction that familiarizes them with the language of chemistry (nomenclature), structure of the atom, ways in which atoms can combine, and the laws governing atomic interactions which form the foundations for all biological, chemical, environmental and geological processes. During second and third year students receive foundational courses in each of the five sub-disciplines of Chemistry. These courses build on the first year introduction and apply those concepts to each of the sub-disciplines, forming a foundation for more in depth study of each of the sub-disciplines which begins in the third year and continues through the fourth year. All students are required to take at least two foundational courses in each of the Chemistry sub-disciplines. Those choosing a 4-year option are able to receive additional specialization in two or more of the sub-disciplines through selection of elective courses that provide advanced, more specialized instruction. At the third-year and fourth-year levels students receive instruction and experience in the various forms of written and oral scientific communications that are core requirements for successful post-graduation employment and career advancement. Consistent with CSC requirements the 4-year degree options require at least 1000 hours of dedicated Chemistry instruction, comprising at least 400 hours each of classroom and laboratory instruction.

3-year B.Sc. Program Outcomes:

Students graduating with a 3-Year B.Sc. in Chemistry from Brandon University will possess:

1. Foundational knowledge in the five core areas of Chemistry;
2. An ability to relate core concepts from the five sub-disciplines of Chemistry to processes that comprise everyday life as well as the various chemical industries;
3. Competency in quantitative laboratory-based work; and
4. An understanding of 'scientific method' and an ability to discuss its importance in relation to careers in the chemical industries.

Career/Graduate School Opportunities:

Entry into second degree options including*: Dentistry, Education, Engineering, Medicine, Pharmacy and Veterinary Medicine

*Students are cautioned that some of these second degree options are in the process of requiring a 4-year degree as a minimum entry standard.

Program Schedule (3-Year B.Sc. in Chemistry)

First year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:160 General Chemistry I (slot 1 or slot 11)	3	18:170 General Chemistry II (slot 11)	3
62:181 Calculus I	3	62:191 Calculus II	3
15:162 Cells, Genetics, and Evolution	3	Open Elective	3
<i>Minor Elective*</i>	3	<i>Minor Elective*</i>	3
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Total Credits	15	Total Credits	15

Second year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:261 Organic Chemistry I (slot 2)	3	18:271 Organic Chemistry II (slot 2)	3
18:262 Introductory Analytical Chemistry (slot 1)	3	18:281 Applied Spectroscopy (slot 1)	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 300/400 Level Chemistry Elective**	3
<i>Minor Elective</i>	3	<i>Minor Elective</i>	3
Open Elective	3	Open Elective	3
Total Credits	15	Total Credits	15

Third year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:363 Biochemistry I (slot 5)	3	300/400 Level Chemistry Elective**	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 300/400 Level Chemistry Elective*	3
<i>Minor Elective</i>	3	<i>Minor Elective</i>	3
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Open Elective	3	Open Elective	3
Total Credits	15	Total Credits	15

Footnote: *For a Math minor, these could be replaced with an open elective

** Both 18:364 Inorganic Chemistry II (slot 3) and 18:373 Biochemistry II (slot 5) will be offered every year which fulfill these 300/400 Level Chemistry Elective requirements, although are not mandatory.

4-year B.Sc. Program Outcomes:

Students graduating with a 4-Year B.Sc. in Chemistry from Brandon University will possess:

1. Foundational knowledge in the five core areas of Chemistry;
2. Advanced knowledge in at least two sub-disciplines of Chemistry;
3. An ability to explain scientific theories to peers from outside the Chemistry field;
4. An ability to read, evaluate, critique and apply the scientific literature;
5. An ability to apply theory from at least two sub-disciplines to real-world laboratory and chemical industry-related problems;
6. An ability to apply scientific method to real world everyday life and industry-related issues;
7. The skills to objectively assess and critique news articles related to the chemical sciences;
8. The skills and knowledge to discuss ethical considerations related to the use of chemicals by humans and its impact on the planet as a whole;
9. The skill set to discuss the application of chemical technologies to societal activities and problems related to consumerism, environment, health and disease, law and warfare;
10. An ability to apply quantitative methods to the analysis of experimental data and to interpret scientific data and make valid scientific conclusions on this basis;
11. A high degree of scientific literacy evidenced by an ability to communicate to peers and the general public hypotheses, methods, results and data interpretation orally and in the form of a written communication; and
12. Knowledge and experience of the presentation of chemical information in the 4 standard scientific formats (oral, poster, research report, literature review).

Career/Graduate School Opportunities:

Certification as a Professional Chemist

Entry into second degree options including: Law, Dentistry, Education, Engineering, Medicine, Pharmacy and Veterinary Medicine

Employment in the vast array of chemistry related industries including but not limited to: Agribusiness, Analytical, Biotechnology, Environmental, Geological, Mining, Petroleum, Pharmaceuticals, and Research laboratories.

Program Schedule (4-Year B.Sc. in Chemistry)

First year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:160 General Chemistry I (slot 1 or slot 11)	3	18:170 General Chemistry II (slot 11)	3
62:181 Calculus I	3	62:191 Calculus II	3
74:161 Foundations of Physics I	3	74:162 Foundations of Physics II	3
15:162 Cells, Genetics, and Evolution	3	Open Elective or 15:163 Biodiversity, Functions, and Interactions ¹	3
Humanities/Social Science Elective or <i>Minor Elective</i> ²	3	Humanities/Social Science Elective or <i>Minor Elective</i> ²	3
Total Credits	15	Total Credits	15

Second year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:261 Organic Chemistry I (slot 2)	3	18:271 Organic Chemistry II (slot 2)	3
18:262 Introductory Analytical Chemistry (slot 1)	3	18:281 Applied Spectroscopy (slot 1)	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 18:364 Inorganic Chemistry II (slot 3)	3
Required Math Elective course	3	Required Math Elective course	3
Open Elective or <i>Minor elective</i> ³	3	Open Elective or <i>Minor elective</i> ³	3
Total Credits	15	Total Credits	15

Third year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:363 Biochemistry I (slot 5)	3	18:373 Biochemistry II (slot 5)	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 18:364 Inorganic Chemistry II (slot 3)	3
Open Elective	3	18:362 Instrumental Analysis (slot 10)	3
<i>Minor Elective</i>	3	<i>Minor Elective</i>	3
Open Elective or Humanities/Social Science Elective ⁴	3	Open Elective or Humanities/Social Science Elective ⁴	3
Total Credits	15	Total Credits	15

Fourth year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
300/400 Level Chemistry Elective	3	300/400 Level Chemistry Elective	3
400 Level Chemistry Elective	3	400 Level Chemistry Elective	3
Open Elective	3	Open Elective	3
Open Elective	3	Open Elective	3
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Total Credits	15	Total Credits	15

Footnotes:

1. If Biology Minor
2. If Minor is not Biology, Math, or Physics
3. If Minor is not Math
4. If Minor is not Math, Biology, or Physics

4-year B.Sc. (Honours) Program Outcomes:

In addition to the learning outcomes for the 4-year degree, students graduating with a 4-Year Honours B.Sc. in Chemistry from Brandon University will possess:

1. An ability to develop and enunciate experimental hypotheses on the basis of available scientific literature. A thorough understanding of the design of experiments for hypothesis testing, with an ability to include appropriate controls and statistical analyses as required; and
2. An ability to integrate theories from multiple chemical sub-disciplines.

Career/Graduate School Opportunities:

Same as the 4-Year B.Sc. Degree plus: M.Sc. and Ph.D. programs

Program Schedule (4-Year Honours B.Sc. in Chemistry)

First year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:160 General Chemistry I (slot 1 or slot 11)	3	18:170 General Chemistry II (slot 11)	3
62:181 Calculus I	3	62:191 Calculus II	3
74:161 Foundations of Physics I	3	74:162 Foundations of Physics II	3
15:162 Cells, Genetics, and Evolution	3	Open Elective or 15:163 Biodiversity, Functions, and Interactions ¹	3
Humanities/Social Science Elective or <i>Minor Elective</i> ²	3	Humanities/Social Science Elective or <i>Minor Elective</i> ²	3
Total Credits	15	Total Credits	15

Second year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:261 Organic Chemistry I (slot 2)	3	18:271 Organic Chemistry II (slot 2)	3
18:262 Introductory Analytical Chemistry (slot 1)	3	18:281 Applied Spectroscopy (slot 1)	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 18:364 Inorganic Chemistry II (slot 3)	3
Required Math Elective course	3	Required Math Elective course	3
Open Elective or <i>Minor elective</i> ³	3	Open Elective or <i>Minor elective</i> ³	3
Total Credits	15	Total Credits	15

Third year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:363 Biochemistry I (slot 5)	3	18:373 Biochemistry II (slot 5)	3
18:260 Physical Chemistry I (slot 4) or 18:274 Inorganic Chemistry I (slot 3)	3	18:270 Physical Chemistry II (slot 4) or 18:364 Inorganic Chemistry II (slot 3)	3
Open Elective	3	18:362 Instrumental Analysis (slot 10)	3
<i>Minor Elective</i>	3	<i>Minor Elective</i>	3
Open Elective or Humanities/Social Science Elective ⁴	3	Open Elective or Humanities/Social Science Elective ⁴	3
Total Credits	15	Total Credits	15

Fourth year			
FALL SEMESTER		WINTER SEMESTER	
COURSE TITLE	CR	COURSE TITLE	CR
18:449 Advanced Research Topics in Chemistry	3	18:449 Advanced Research Topics in Chemistry	3
400 Level Chemistry Elective	3	400 Level Chemistry Elective	3
300/400 Level Chemistry Elective	3	300/400 Level Chemistry Elective	3
Open Elective	3	Open Elective	3
Humanities/Social Science Elective	3	Humanities/Social Science Elective	3
Total Credits	15	Total Credits	15

Footnotes:

1. If Biology Minor
2. If Minor is not Biology, Math, or Physics
3. If Minor is not Math
4. If Minor is not Math, Biology, or Physics



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