CHEMISTRY (CHEM)

Updated January. 15, 2026

Chair: Professor J. Hollett; **Professors:** D. Craig, D. Goltz, C. Wiebe; **Associate Professors:** M. Eze, A. McCubbin, J. Ritch, D. Vanderwel, T. Wood; **Instructors:** K. Buffie, J. Galka, D. Latimer, K. Stevenson

DEGREES/PROGRAMS OFFERED

3-Year BSc
3-Year BSc (Business Stream)
4-Year BSc
4-Year BSc (Business Stream)
Honours BSc
Honours BSc (Business Stream)
Minor

INTRODUCTION

Chemistry is the study of the property and composition of matter, the transformations that matter may undergo, and the energies associated with such transformations. There are five main areas of chemistry: analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, and biochemistry. The department offers a solid foundation in each of these areas, plus more advanced courses for specialization at the senior level.

The Department of Chemistry offers 3-year, 4-year, and Honours BSc degrees in Chemistry. The department is also involved in several other interdisciplinary programs, most notably Biochemistry, Chemical Physics, and Environmental Studies (Chemistry Stream). An additional option available is the 4-year BSc program in Applied Chemistry, offered jointly by the University of Winnipeg and Red River College. Students pursuing a 3-year or 4-year BSc in Chemistry have the opportunity to take a Business Stream – a set of core courses in the Faculty of Business that will provide them with the skills needed to enter and succeed in industry and business. After completing the requirements of the BSc degree and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar, it will be noted on the student's transcript that they have satisfied the requirements of a BSc degree with a Business stream.

Chemists are involved in many fields, including environmental protection, pharmaceutical science, forensic science, toxicology, agricultural science, food science, education, geochemistry, biochemistry, materials science, biotechnology, oceanography, computer modelling, and plant management. Graduates from a 3-year BSc in Chemistry may proceed to professional schools in a health-related area (such as pharmacy, medicine, veterinary medicine, or dentistry), or to careers as diverse as education, library science, business administration, public administration, engineering and law. Graduates with 4-year or Honours degrees in Chemistry usually proceed directly to employment or to graduate school (to obtain an MSc or PhD degree). Ultimately, most obtain jobs either as technicians, managers, consultants or research scientists in industry or in government.

Arts students, with the required prerequisites, may take **CHEM-1111(3)** Introduction to the Chemical Properties of Matter, **CHEM-1112(3)** Basic Principles of Reactivity, or **CHEM-2801(3)** Environmental Issues: A Chemistry Perspective towards their Science requirement.

GENERAL INFORMATION

Prerequisites
Chemistry 40S **AND** either Pre-Calculus **OR** Applied Mathematics 40S are required for acceptance to the Chemistry Major program.

Laboratory Work
Laboratory work has been designed to complement the lecture material; students are able to work in small lab sections with the possibility of individual projects. In advanced labs, modern instrumental techniques and computer facilities are used extensively.

Pre-professional Program Requirements
Students planning to enter the Faculties of Dentistry or Medicine are required to take the following courses:

CHEM-1111(3)	Introduction to the Chemical Properties of Matter
CHEM-1112(3)	Basic Principles of Chemical Reactivity
CHEM-2202(3)	Organic Chemistry I
CHEM-2203(3)	Organic Chemistry II
CHEM-3502(3)	Intermediate Biochemistry I
CHEM-3503(3)	Intermediate Biochemistry II

Students planning to enter professional faculties would normally take the above courses in sequence. However, provided that a minimum grade of 75 (or equivalent) was obtained in Chemistry 40S, the course **CHEM-1111(3)** may be taken concurrently with **CHEM-2202(3)**, while **CHEM-1112(3)** may be taken concurrently with **CHEM-2203(3)**. Also, provided that a minimum grade of B+ was obtained in both **CHEM-1111(3)** and **CHEM-1112(3)**, the course **CHEM-2202(3)** may be taken concurrently with **CHEM-3502(3)**, while **CHEM-2203(3)** may be taken concurrently with **CHEM-3503(3)**.

REQUIREMENTS FOR THE 3-YEAR BSc IN CHEMISTRY

ADMISSION REQUIREMENT Students must consult with a department advisor in planning their course of study.

GRADUATION REQUIREMENT 90 credit hours

RESIDENCE REQUIREMENT

Degree:	Minimum 30 credit hours
Major:	Minimum 18 credit hours

GENERAL DEGREE REQUIREMENT

Humanities:	12 credit hours in Humanities
Writing:	Minimum 3 credit hours of Academic Writing.
Indigenous:	3 credit hours in designated Indigenous requirement courses
Maximum Introductory Courses:	Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 48 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution:	Minimum three (3) credit hours from each of five (5) different subjects.

MAJOR REQUIREMENT

Single Major:	Minimum 33 credit hours/Maximum 48 credit hours in Major subject.
Double Major:	33 credit hours in Chemistry and specified number of credit hours in the other department/program.

Required courses:

CHEM-1111(3) Introduction to the Chemical Properties of Matter
CHEM-1112(3) Basic Principles of Chemical Reactivity
CHEM-2102(3) Thermodynamics and Kinetics
OR CHEM-2103(3) Atoms, Molecules and Spectroscopy
CHEM-2202(3) Organic Chemistry I
CHEM-2203(3) Organic Chemistry II
CHEM-2302(3) Quantitative Chemical Analysis
CHEM-2401(3) Inorganic Chemistry I
MATH-1101(6) Introduction to Calculus
OR MATH-1103(3) Introduction to Calculus I
AND MATH-1104(3) Introduction to Calculus II
PHYS-1101(6) Foundations of Physics I
OR PHYS-1301(6) Introduction to Physics

Plus an additional 12 credit hours of 2000-, 3000-, and/or 4000-level Chemistry courses.

Combined Major:

Prescribed Courses:

15 credit hours from CHEM-2102(3) Thermodynamics, CHEM-2202(3) Organic Chemistry I, CHEM-2203(3) Organic Chemistry II, CHEM-2302(3) Quantitative Chemical Analysis, CHEM-2401(3) Inorganic Chemistry I.

3 credit hours from CHEM-3101(3) Physical Chemistry of Condensed Phases, CHEM-3102(3) Quantum Chemistry and Spectroscopy, CHEM-3202(3) Reaction Mechanisms in Organic Chemistry, CHEM-3204(3) Organic Structure Determination, CHEM-3205(3) Organic Synthesis, CHEM-3302(3) Methods of Chemical Analysis, CHEM-3401(3) Inorganic Chemistry II, CHEM-3502(3) Intermediate Biochemistry I, CHEM-3503(3) Intermediate Biochemistry II, CHEM-3601(3) Environmental Chemistry.

Students must complete a Declaration of Major in a three-year Degree Program form, available from Student Central, before entering Year 2 of their studies.
Students are advised to consult with the Department when planning their studies.

REQUIREMENTS FOR THE 3-YEAR BSc IN CHEMISTRY WITH A BUSINESS STREAM

Students must complete the requirements of the 3-year BSc in Chemistry degree (see previous section) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar.

REQUIREMENTS FOR THE 4-YEAR BSc IN CHEMISTRY

ADMISSION REQUIREMENT Students must consult with a department advisor when planning their studies.

GRADUATION REQUIREMENT 120 credit hours, that is, 90 credit hours meeting the requirements for the 3-Year BSc plus 30 additional credit hours**.**

RESIDENCE REQUIREMENT

Degree: Minimum 60 credit hours
Major: Minimum 30 credit hours

GENERAL DEGREE REQUIREMENT

Humanities: 12 credit hours in Humanities.
Writing: Minimum 3 credit hours of Academic Writing.
Indigenous: 3 credit hours in designated Indigenous requirement courses
Maximum Introductory Courses: Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 78 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution: Minimum three (3) credit hours from each of five (5) different subjects.

MAJOR REQUIREMENT

Single Major: Minimum 54 credit hours/Maximum 78 credit hours in the Major subject.
Maximum total of cognate and major courses is 84 credit hours combined.
Double Major: Minimum 54 credit hours in Chemistry and specified number of credit hours in other Major.

Required courses:

CHEM-1111(3) Introduction to the Chemical Properties of Matter
CHEM-1112(3) Basic Principles of Chemical Reactivity
CHEM-2102(3) Thermodynamics and Kinetics
CHEM-2103(3) Atoms, Molecules and Spectroscopy
CHEM-2202(3) Organic Chemistry I
CHEM-2203(3) Organic Chemistry II
CHEM-2302(3) Quantitative Chemical Analysis
CHEM-2401(3) Inorganic Chemistry I
CHEM-2502(3) Introduction to Biochemistry
OR CHEM-3502(3) Intermediate Biochemistry I
CHEM-3302(3) Methods of Chemical Analysis
CHEM-3401(3) Inorganic Chemistry II: Coordination Chemistry
MATH-1101(6) Introduction to Calculus
OR MATH-1103(3) Introduction to Calculus I
AND MATH-1104(3) Introduction to Calculus II
PHYS-1101(6) Foundations of Physics I
OR PHYS-1301(6) Introduction to Physics

Minimum 3 credit hours selected from the following courses:

PSYC-2101(3) Introduction to Data Analysis
STAT-1301(3) Statistical Analysis I
STAT-1401(3) Statistics I for Business and Economics
STAT-1501(3) Elementary Biological Statistics I

Any Mathematics course numbered 2000 or above (MATH-2xxx) with the exceptions of MATH-2903(3) (Mathematics for Early/Middle Years Teachers I) and MATH-2904(3) (Mathematics for Early/Middle Years Teachers II)

A minimum of 3 credits hours in Applied Computer Science or Biology OR an additional 3 credit hours in Physics or Mathematics and Statistics, excluding MATH-1301 (Applied Mathematics for Business and Administration, MATH-2903 and MATH-2904.

An additional 21 credit hours of 2000-, 3000- and/or 4000-level Chemistry courses.

Selection of Chemistry Courses: The 4-Year major requires a minimum of 54 credit hours in Chemistry. Since some senior courses are given in alternate years, all 4-Year majors are urged to seek academic advising within the Department **EACH YEAR** to avoid potential scheduling problems.

The following pattern of Chemistry courses is suggested:

Year 1 - 6 credit hours: **CHEM-1111(3)** Introduction to the Chemical Properties of Matter; **CHEM-1112(3)** Basic Principles of Chemical Reactivity.

Year 2 - 12 to 18 credit hours of the following required courses: **CHEM-2102(3)** Thermodynamics and Kinetics; **CHEM-2103(3)** Atoms, Molecules and Spectroscopy; **CHEM-2202(3)** Organic Chemistry I; **CHEM-2203(3)** Organic Chemistry II; **CHEM-2302(3)** Quantitative Chemical Analysis; **CHEM-2401(3)** Inorganic Chemistry I; **CHEM-2502 (3)** Introduction to Biochemistry; **CHEM-3302(3)** Methods of Chemical Analysis; **CHEM-3401(3)** Inorganic Chemistry II.
Note: If **CHEM-3401(3)** is selected then **CHEM-2202(3)** and **CHEM-2203(3)** must also be taken in Year 2. Students are advised to consult with the Department.

Year 3 - 18 credit hours in Chemistry, including the required courses that were not taken in Year 2.

Year 4 - 18 credit hours in Chemistry.

Note: A student would normally specialize in one or more areas of Chemistry (Analytical, Organic, Physical, Inorganic, Biochemistry) in Years 3 and 4 and should seek advice concerning course selection.

Note: It is recommended the following be taken in :
Year 1: **MATH-1103(3**) Introduction to Calculus I
AND MATH-1104(3) Introduction to Calculus II
Year 1 or 2: **PHYS-1101(6)** Foundations of Physics I **OR PHYS-1301(6)** Introduction to Physics

Students must complete a 4-Year BSc Degree form, available from Student Services.

Combined Major:

Prescribed Courses:
15 credit hours from CHEM-2202(3) Organic Chemistry I, CHEM-2203(3) Organic Chemistry II, CHEM-2102(3) Thermodynamics and Kinetics, CHEM-2302(3) Quantitative Chemical Analysis, CHEM-2401(3) Inorganic Chemistry I.

3 credit hours from CHEM-3101(3) Physical Chemistry of Condensed Phases, CHEM-3102(3) Quantum Chemistry and Spectroscopy, CHEM-3202(3) Reaction Mechanisms in Organic Chemistry, CHEM-3204(3) Organic Structure Determination, CHEM-3205(3) Organic Synthesis, CHEM-3302(3) Methods of Chemical Analysis, CHEM-3401(3) Inorganic Chemistry II, CHEM-3502(3) Intermediate Biochemistry I, CHEM-3503(3) Intermediate Biochemistry II, CHEM-3601(3) Environmental Chemistry.

REQUIREMENTS FOR THE 4-YEAR BSc IN CHEMISTRY WITH A BUSINESS STREAM

Students must complete the requirements of the 4-year BSc in Chemistry degree (see previous section) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar.

REQUIREMENTS FOR THE BSc (HONOURS) IN CHEMISTRY

ADMISSION REQUIREMENT Students must have completed 30 credit hours.
Students must consult with and have the approval of the Department Chair or the Chair's designate when planning their studies**.**

GRADUATION REQUIREMENT 120 credit hours
Graduation GPA Requirement: To graduate with a BSc (Honours), students must have a minimum GPA of 3.0 on all major (Chemistry) courses which will be calculated on all course attempts in the major, and a minimum GPA of 2.75 on all non-major courses which will be calculated as for the general degree.

RESIDENCE REQUIREMENT
Degree: Minimum 60 credit hours
Honours: Minimum 30 credit hours**,** including minimum 18 credit hours at upper level (3000/4000) of which a minimum of 9 credit hours at 4000 level.

GENERAL DEGREE REQUIREMENT
Humanities: 12 credit hours in Humanities.
Writing: Minimum 3 credit hours of Academic Writing.
Indigenous: 3 credit hours in designated Indigenous requirement courses

Maximum Introductory Courses: Students may use a maximum of 42 credit hours at the 1000 level. Of these, a maximum of 6 credit hours may be below the 1000 level. As a result, students must take a minimum of 78 credit hours at the 2000-level or above in order to not exceed the maximum number of introductory courses.
Distribution: Minimum three (3) credit hours from each of five (5) different subjects.

HONOURS REQUIREMENT
Single Honours: Minimum 60 credit hours in the Major subject.
Minimum 30 credit hours in upper-level (3000 and 4000) Honours subject courses of which a minimum of 12 credit hours must be at the 4000 level.

Required courses:

CHEM-1111(3) Introduction to the Chemical Properties of Matter
CHEM-1112(3) Basic Principles of Chemical Reactivity
CHEM-2102(3) Thermodynamics and Kinetics
CHEM-2103(3) Atoms, Molecules and Spectroscopy
CHEM-2202(3) Organic Chemistry I
CHEM-2203(3) Organic Chemistry II
CHEM-2302(3) Quantitative Chemical Analysis
CHEM-2401(3) Inorganic Chemistry
CHEM-2502(3) Introduction to Biochemistry
OR CHEM-3502(3) Intermediate Biochemistry I
CHEM-3302(3) Methods of Chemical Analysis
CHEM-3401(3) Inorganic Chemistry II
CHEM-4701(6) Research Projects in Chemistry
MATH-1103(3) Introduction to Calculus I
MATH-1104(3) Introduction to Calculus II
PHYS-1101(6) Foundations of Physics I
OR PHYS-1301(6) Introduction to Physics

Minimum 3 credit hours selected from the following courses:

PSYC-2101(3) Introduction to Data Analysis
STAT-1301(3) Statistical Analysis I
STAT-1401(3) Statistics I for Business and Economics
STAT-1501(3) Elementary Biological Statistics I
Any Mathematics course numbered 2000 or above (MATH-2xxx) with the exceptions of MATH-2903(3) (Mathematics for Early/Middle Years Teachers I) and MATH-2904(3) (Mathematics for Early/Middle Years Teachers II).

An additional 21 credit hours of 2000/3000/4000-level Chemistry courses, of which 6 credit hours must be at the 4000-level.

Plus an additional 18 credit hours selected from at least 2 of the following departments: Applied Computer Science, Biology, Environmental Studies, Geography, Physics, and Mathematics and Statistics, excluding MATH-1301 (Applied Mathematics for Business Administration), MATH-2903 and MATH-2904. Courses from other departments may be considered but require approval from the Chair. Of the 18 credit hours, 3 credit hours MUST be from Applied Computer Science, Biology, Mathematics, or Physics

Students must complete an Honours BSc Degree form, available from Student Central.

REQUIREMENTS FOR THE HONOURS BSc IN CHEMISTRY WITH A BUSINESS STREAM

Students must complete the requirements of the Honours BSc in Chemistry degree (see previous section) and the set of core courses indicated in the "Science with a Business Stream" section of the Calendar.

REQUIREMENTS FOR A MINOR IN CHEMISTRY

Degree:	Students completing any undergraduate degree program are eligible to complete the minor.
Minor:	18 credit hours in the minor subject, with a minimum of 12 credit hours above the 1000-level.
Residence Requirement:	Minimum 12 credit hours in the minor subject.
Restrictions:	Students cannot declare the same subject as a major and a minor.

Required Courses:
CHEM-1111(3) Introduction to the Chemical Properties of Matter
CHEM-1112(3) Basic Principles of Chemical Reactivity
A minimum of 9 credit hours from the following:

CHEM-2102(3) Thermodyanamics and Kinetics
CHEM-2103(3) Atoms, Molecules and Spectroscopy
CHEM-2202(3) Organic Chemistry I
CHEM-2203(3) Organic Chemistry II
CHEM-2302(3) Quantitative Chemical Analysis
CHEM-2401(3) Inorganic Chemistry I
CHEM-2502(3) Introduction to Biochemistry

An additional 3 credit hours of any Chemistry course at the 3000-level or higher

Students must complete a minor declaration form, available from Student Services.

COURSE LISTINGS

Students should use WebAdvisor to find the courses to be offered in the upcoming term. **A number of senior courses are offered on a rotation basis and are given in alternate years.** Students are advised to consult with the Department **in advance** when planning their curriculum.

CHEM-0100(3) Foundations of Chemistry
CHEM-1111(3) Introduction to the Chemical Properties of Matter
CHEM-1112(3) Basic Principles of Chemical Reactivity
CHEM-2102(3) Thermodynamics and Kinetics
CHEM-2103(3) Atoms, Molecules and Spectroscopy
CHEM-2202(3) Organic Chemistry I
CHEM-2203(3) Organic Chemistry II
CHEM-2302(3) Quantitative Chemical Analysis
CHEM-2401(3) Inorganic Chemistry I
CHEM-2502(3) Introduction to Biochemistry
CHEM-2701(3) Computer Techniques and Applications for Chemistry
CHEM-2801(3) Environmental Issues: A Chemistry Perspective
CHEM-3101(3) Physical Chemistry of Condensed Phases
CHEM-3102(3) Quantum Chemistry and Spectroscopy
CHEM-3202(3) Reaction Mechanisms in Organic Chemistry
CHEM-3204(3) Organic Structure Determination
CHEM-3205(3) Organic Synthesis
CHEM-3206(3) Advanced Organic Chemistry Laboratory
CHEM-3302(3) Methods of Chemical Analysis
CHEM-3401(3) Inorganic Chemistry II: Coordination Chemistry

CHEM-3502(3) Intermediate Biochemistry I: Structure, Function, and Energetics of Biomolecules
CHEM-3503(3) Intermediate Biochemistry II: Intermediary Metabolism
CHEM-3504(3) Plant Biochemistry
CHEM-3601(3) Environmental Chemistry
CHEM/ENV-3611(3) Environmental Toxicology
CHEM-3701(3) Directed Studies in Chemistry
CHEM-4101(3) Quantum Chemistry
CHEM-4204(3) Medicinal Chemistry
CHEM-4302(3) Instrumentation for Quantitative Analysis
CHEM-4303(3) Analytical Separations
CHEM-4401(3) Organometallic d-Block Chemistry
CHEM-4403(3) Advanced Main Group Chemistry
CHEM-4502(3) Molecular Enzymology
CHEM-4506(3) Methods in Biochemistry
CHEM-4701(6) Research Projects in Chemistry
CHEM-4703(3) Topics in Chemistry

COURSE DESCRIPTIONS

All course descriptions for all undergraduate programs can now be found in one large PDF called “Course Descriptions” in the “Academic Calendar” section of the University website:
http://uwinnipeg.ca/academics/calendar/index.html