Nanoscience

This section presents the requirements for programs in:

- Nanoscience B.Sc. Honours

Program Requirements

Nanoscience

B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.5 credits)

1. 5.0 credits in:

- CHEM 1001 [0.5] General Chemistry I
- CHEM 1002 [0.5] General Chemistry II
- CHEM 2103 [0.5] Physical Chemistry I
- CHEM 2501 [0.5] Introduction to Inorganic and Bioinorganic Chemistry
- CHEM 3100 [0.5] Physical Chemistry II
- CHEM 3107 [0.5] Introduction to Nanotechnology
- CHEM 3503 [0.5] Inorganic Chemistry I
- CHEM 3600 [0.5] Introduction to Nanotechnology
- CHEM 4908 [1.0] Research Project and Seminar

2. 1.0 credit from:

- CHEM 2203 [0.5] Organic Chemistry I
- CHEM 2204 [0.5] Organic Chemistry II
- CHEM 2302 [0.5] Analytical Chemistry I
- CHEM 2303 [0.5] Analytical Chemistry II

3. 1.0 credit from:

- CHEM 4103 [0.5] Surface Chemistry and Nanostructures
- CHEM 4104 [0.5] Physical Methods of Nanotechnology
- CHEM 4201 [0.5] Macromolecular Nanotechnology

4. 3.5 credits in:

- ELEC 2501 [0.5] Circuits and Signals
- ELEC 2507 [0.5] Electronics I
- ELEC 3908 [0.5] Physical Electronics
- ELEC 3105 [0.5] Electromagnetic Fields
- ELEC 4609 [0.5] Integrated Circuit Design and Fabrication
- ELEC 4700 [0.5] The Physics and Modeling of Advanced Devices and Technologies
- ELEC 4704 [0.5] Nanoscale Technology and Devices

5. 1.0 credit from:

- ELEC 2607 [0.5] Switching Circuits
- ELEC 3500 [0.5] Digital Electronics
- ELEC 3509 [0.5] Electronics II
- ELEC 3909 [0.5] Electromagnetic Waves

B. Credits Not Included in the Major CGPA (8.5 credits)

6. 2.5 credits in:

- MATH 1004 [0.5] Calculus for Engineering or Physics
- MATH 1005 [0.5] Differential Equations and Infinite Series for Engineering or Physics
- MATH 1104 [0.5] Linear Algebra for Engineering or Science
- MATH 2004 [0.5] Multivariable Calculus for Engineering or Physics

7. 1.0 credits in:

- STAT 3502 [0.5] Probability and Statistics
- PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics
- PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion

8. 1.5 credits in Advanced Science Faculty Electives:

9. 0.5 credit in Science Continuation (not CHEM)

10. 0.5 credit in:

- NSCI 1000 [0.5] Seminar in Science

  (or approved courses outside the faculties of Science and Engineering and Design)

11. 1.5 credits in approved courses outside the faculties of Science and Engineering and Design

12. 1.0 credit in free electives

Total Credits: 20.0

B.Sc. Regulations

The regulations presented in this section apply to all Bachelor of Science programs. In addition to the requirements presented here, students must satisfy the University regulations common to all undergraduate students including the process of Academic Continuation Evaluation (see the Academic Regulations of the University section of this Calendar).

Breadth Requirement for the B.Sc.

Students in a Bachelor of Science program must present the following credits at graduation:

1. 2.0 credits in Science Continuation courses not in the major discipline; students completing a double major are considered to have completed this requirement providing they have 2.0 credits in Science Continuation courses in each of the two majors;

2. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000)

In most cases, the requirements for individual B.Sc. programs, as stated in this Calendar, contain these requirements, explicitly or implicitly.

Students admitted to B.Sc. programs by transfer from another institution must present at graduation (whether taken at Carleton or elsewhere):

1. 2.0 credits in courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000) if the student received fewer than 10.0 transfer credits; or,

2. 1.0 credit in courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000) if the student received 10.0 or more transfer credits.

Declared and Undeclared Students

Degree students are considered “Undeclared” if they have been admitted to a degree, but have not yet selected and been accepted into a program within that degree. The status “Undeclared” is available only in the B.A. and B.Sc. degrees. Undeclared students must apply to enter a program upon or before completing 3.5 credits.
Change of Program within the B.Sc. Degree

To transfer to a program within the B.Sc. degree, applicants must normally be Eligible to Continue (EC) in the new program, by meeting the CGPA thresholds described in Section 3.1.9 of the Academic Regulations of the University.

Applications to declare or change programs within the B.Sc. degree must be made online through Carleton Central by completing a Change of Program Elements (COPE) application form published within the relevant Calendar entry. Acceptance into a program, or into a program element or option, is subject to any enrolment limitations, and/or specific program, program element or option requirements as published in the relevant Calendar entry.

Minors, Concentrations, and Specializations

Students may add a Minor, Concentration, or Specialization by completing a Change of Program Elements (COPE) application form online through Carleton Central. Acceptance into a Minor, Concentration, or Specialization normally requires that the student be Eligible to Continue (EC) and is meeting the minimum CGPAs described in Section 3.1.9 of the Academic Regulations of the University, as well as being subject to any specific requirements of the intended Minor, Concentration, or Specialization as published in the relevant Calendar entry.

Experimental Science Requirement

Students in a B.Sc. degree program must present at graduation at least two full credits of Experimental Science chosen from two different departments or institutes from the list below:

Approved Experimental Science Courses

**Biochemistry**
- BIOC 2200 [0.5] Cellular Biochemistry
- BIOC 4001 [0.5] Methods in Biochemistry
- BIOC 4201 [0.5] Advanced Cell Culture and Tissue Engineering

**Biology**
- BIOL 1103 [0.5] Foundations of Biology I
- BIOL 1104 [0.5] Foundations of Biology II
- BIOL 2001 [0.5] Animals: Form and Function
- BIOL 2002 [0.5] Plants: Form and Function
- BIOL 2104 [0.5] Introductory Genetics
- BIOL 2200 [0.5] Cellular Biochemistry
- BIOL 2600 [0.5] Ecology

**Chemistry**
- CHEM 1001 [0.5] General Chemistry I
- CHEM 1002 [0.5] General Chemistry II
- CHEM 1005 [0.5] Elementary Chemistry I
- CHEM 1006 [0.5] Elementary Chemistry II
- CHEM 2103 [0.5] Physical Chemistry I
- CHEM 2203 [0.5] Organic Chemistry I
- CHEM 2204 [0.5] Organic Chemistry II
- CHEM 2302 [0.5] Analytical Chemistry I
- CHEM 2303 [0.5] Analytical Chemistry II
- CHEM 2800 [0.5] Foundations for Environmental Chemistry

**Earth Sciences**
- ERTH 1006 [0.5] Exploring Planet Earth
- ERTH 1009 [0.5] The Earth System Through Time
- ERTH 2102 [0.5] Mineralogy to Petrology
- ERTH 2404 [0.5] Engineering Geoscience
- ERTH 2802 [0.5] Field Geology I
- ERTH 3111 [0.5] Vertebrate Evolution: Mammals, Reptiles, and Birds
- ERTH 3112 [0.5] Vertebrate Evolution: Fish and Amphibians
- ERTH 3204 [0.5] Mineral Deposits
- ERTH 3205 [0.5] Physical Hydrogeology
- ERTH 3806 [0.5] Structural Geology

**Food Sciences**
- FOOD 3001 [0.5] Food Chemistry
- FOOD 3002 [0.5] Food Analysis
- FOOD 3005 [0.5] Food Microbiology

**Geography**
- GEOG 1010 [0.5] Global Environmental Systems
- GEOG 3108 [0.5] Soil Properties

**Neuroscience**
- NEUR 3206 [0.5] Sensory and Motor Neuroscience
- NEUR 3207 [0.5] Systems Neuroscience
- NEUR 4600 [0.5] Advanced Lab in Neuroanatomy

**Physics**
- PHYS 1001 [0.5] Foundations of Physics I
- PHYS 1002 [0.5] Foundations of Physics II
- PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics
- PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion
- PHYS 1007 [0.5] Elementary University Physics I
- PHYS 1008 [0.5] Elementary University Physics II
- PHYS 2202 [0.5] Wave Motion and Optics
- PHYS 2604 [0.5] Modern Physics I
- PHYS 3007 [0.5] Third Year Physics Laboratory: Selected Experiments and Seminars
- PHYS 3606 [0.5] Modern Physics II
- PHYS 3608 [0.5] Modern Applied Physics

Course Categories for B.Sc. Programs

**Science Geography Courses**
- GEOG 1010 [0.5] Global Environmental Systems
- GEOG 2006 [0.5] Introduction to Quantitative Research
- GEOG 2013 [0.5] Weather and Water
- GEOG 2014 [0.5] The Earth's Surface
- GEOG 3003 [0.5] Quantitative Geography
- GEOG 3010 [0.5] Field Methods in Physical Geography
- GEOG 3102 [0.5] Geomorphology
- GEOG 3103 [0.5] Watershed Hydrology
- GEOG 3104 [0.5] Principles of Biogeochemistry
- GEOG 3105 [0.5] Climate and Atmospheric Change
- GEOG 3106 [0.5] Aquatic Science and Management
- GEOG 3108 [0.5] Soil Properties
- GEOG 4000 [0.5] Field Studies
GEOG 4005 [0.5] Directed Studies in Geography
GEOG 4013 [0.5] Cold Region Hydrology
GEOG 4017 [0.5] Global Biogeochemical Cycles
GEOG 4101 [0.5] Two Million Years of Environmental Change
GEOG 4103 [0.5] Water Resources Engineering
GEOG 4104 [0.5] Microclimatology
GEOG 4108 [0.5] Permafrost

Science Psychology Courses
PSYC 2001 [0.5] Introduction to Research Methods in Psychology
PSYC 2002 [0.5] Introduction to Statistics in Psychology
PSYC 2700 [0.5] Introduction to Cognitive Psychology
PSYC 3000 [1.0] Design and Analysis in Psychological Research
PSYC 3506 [0.5] Cognitive Development
PSYC 3700 [1.0] Cognition (Honours Seminar)
PSYC 3702 [0.5] Perception
PSYC 2307 [0.5] Human Neuropsychology I
PSYC 3307 [0.5] Human Neuropsychology II

Science Continuation Courses
A course at the 2000 level or above may be used as a Science Continuation credit in a B.Sc. program if it is not in the student's major discipline, and is chosen from the following:

- BIOC (Biochemistry)
- BIOL (Biology) Biochemistry students may use BIOL 2005 only as a free elective.
- CHEM (Chemistry)
- COMP (Computer Science) A maximum of two half-credits at the 1000-level in COMP, excluding COMP 1001 may be used as Science Continuation credits.
- ERTH (Earth Sciences), except ERTH 2415 which may be used only as a free elective for any B.Sc. program. Students in Earth Sciences programs may use ERTH 2401, ERTH 2402, and ERTH 2403 only as free electives.
- Engineering. Students wishing to register in Engineering courses must obtain the permission of the Faculty of Engineering and Design.
- ENSC (Environmental Science)
- FOOD (Food Science and Nutrition)
- GEOM (Geomatics)
- HLTH (Health Sciences)
- ISAP (Interdisciplinary Science Practice)
- MATH (Mathematics)
- NEUR (Neuroscience)
- PHYS (Physics) except PHYS 1901, PHYS 1902, PHYS 1905, PHYS 2903
- Science Geography (see list above)
- Science Psychology (see list above)
- STAT (Statistics)
- TSES (Technology, Society, Environment) Biology students may use these courses only as free electives.

Advanced Science Faculty Electives
Advanced Science Faculty Electives are courses at the 2000-4000 level chosen from the Science Faculty Electives list above.

Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)
All courses offered by the Faculty of Arts and Social Sciences, the Faculty of Public Affairs, and the Sprott School of Business are approved as Arts or Social Sciences courses EXCEPT FOR: All Science Geography courses (see list above), all Geomatics (GEOM) courses, all Science Psychology courses (see list above). NSCI 1000 may be used as an Approved Course Outside the Faculties of Science and Engineering and Design.

Free Electives
Any course is allowable as a Free Elective providing it is not prohibited (see below). Students are expected to comply with prerequisite requirements and enrolment restrictions for all courses as published in this Calendar.

Courses Allowable Only as Free Electives in any B.Sc. Program
- BIOL 4810 [0.5] Education Research in Undergraduate Science
- CHEM 1003 [0.5] The Chemistry of Food, Health and Drugs
The overall average required for admission is determined each year on a program-by-program basis. Holding the minimum admission requirements only establishes eligibility for consideration; higher averages are required for admission to programs for which the demand for places by qualified applicants exceeds the number of places available. All programs have limited enrolment and admission is not guaranteed. Some programs may also require specific course prerequisites and prerequisite averages and/or supplementary admission portfolios. Consult admissions.carleton.ca for further details.

Note: If a course is listed as *recommended*, it is not mandatory for admission. Students who do not follow the recommendations will not be disadvantaged in the admission process.

### Degrees
- B.Sc. (Honours)
- B.Sc. (Major)
- B.Sc.

### Admission Requirements

#### B. Sc. Honours

**First Year**

The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. For most programs including Biochemistry, Bioinformatics, Biotechnology, Chemistry, Combined Honours in Biology and Physics, Chemistry and Physics, Computational Biochemistry, Food Science, Nanoscience, Neuroscience and Biology, Neuroscience and Mental Health, and Psychology, the six 4U or M courses must include Advanced Functions, and two of Biology, Chemistry, Earth and Space Sciences, or Physics. (Calculus and Vectors is strongly recommended).

#### Specific Honours Admission Requirements

For the Honours programs in Earth Sciences, Environmental Science, Geomatics, Interdisciplinary Science and Practice, and Physical Geography, Calculus and Vectors may be substituted for Advanced Functions. For the Honours programs in Physics and Applied Physics, and for double Honours in Mathematics and Physics, Calculus and Vectors is required in addition to Advanced Functions and one of 4U Physics, Chemistry, Biology, or Earth and Space Sciences. For all programs in Physics, 4U Physics is strongly recommended. For Honours in Psychology, a 4U course in English is recommended.

For Honours in Environmental Science, a 4U course in Biology and Chemistry is recommended.

### Advanced Standing

Applications for admission beyond first year will be assessed on their merits. Applicants must normally be *Eligible to Continue* in their year level, in addition to meeting the CGPA thresholds described in Section 3.1.9 of the Academic Regulations of the University. Advanced standing will be granted only for those subjects deemed appropriate for the program and stream selected.
B.Sc. Major and B.Sc.
First Year
The Ontario Secondary School Diploma (OSSD) or equivalent including a minimum of six 4U or M courses. The six 4U or M courses must include Advanced Functions and two of Calculus and Vectors, Biology, Chemistry, Earth and Space Science, or Physics (Calculus and Vectors is strongly recommended). For the B.Sc. Major in Physics, 4U Physics is strongly recommended.

Advanced Standing
Applications for admission beyond first year will be assessed on their merits. Applicants must normally be Eligible to Continue (EC) in their year level. Advanced standing will be granted only for those subjects deemed appropriate for the program and stream selected.

Co-op Option
Direct Admission to the First Year of the Co-op Option
Applicants must:
1. meet the required overall admission cut-off average and prerequisite course average. These averages may be higher than the stated minimum requirements;
2. be registered as a full-time student in the Bachelor of Science Honours program;
3. be eligible to work in Canada (for off-campus work placements).

Note that meeting the above requirements only establishes eligibility for admission to the program. The prevailing job market may limit enrolment in the co-op option.

Note: continuation requirements for students previously admitted to the co-op option and admission requirements for the co-op option after beginning the program are described in the Co-operative Education Regulations section of this Calendar.