Integrated Science 1001X (Winter 2024–25) Exploring Science

Course Description & Prerequisite Requirements

Calendar description: Explore foundational topics in astronomy, biology, chemistry, earth science, mathematics, and physics through an integrated questions-based approach. Small-group interactions and interdisciplinary laboratory experiments are designed to foster teamwork, interdisciplinary thinking, and the development problem-solving and critical-thinking skills.

Extra information: 13 lecture hours and 10 laboratory/tutorial hours per week, 2.0 course.

Prerequisites: Enrolment in Year 1 of the Western Integrated Science program and a minimum of 60% in each of Calculus 1000A/B or Calculus 1500A/B; Chemistry 1301A/B; and Physics 1201A/B or Physics 1501A/B or the former Physics 1301A/B.

Antirequisites: Chemistry 1302A/B; Physics 1102A/B, Physics 1202A/B, Physics 1502A/B, the former Physics 1029A/B, and the former Physics 1302A/B; Biology 1002B; Mathematics 1225A/B; Calculus 1301A/B and Calculus 1501A/B.

Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Learning Outcomes

Broadly speaking, a student receiving credit for the course will be expected to reliably demonstrate competence in their ability to:

- Think critically about, explain, integrate, and apply scientific principles, laws, and theories.
- Solve a variety of novel problems, whether qualitative, quantitative, or mathematical.
- Draw scientific conclusions from experimental results or data.
- Examine, integrate, and assess any provided or collected scientific data.
- Communicate scientific thoughts and ideas both verbally and in writing.
- Obtain, evaluate, and integrate information from various sources, and determine its relevance.
- Analyze and critically assess problems, and take a systematic approach to solving them.
- Use a variety of laboratory equipment and instrumentation.
- Safely execute a variety of experimental procedures and explain the theory behind them.
- Form productive and collaborative working relationships with other individuals.
- Prioritize a set of tasks and manage the use of their time.

Diversity and Inclusion

In an ideal world, science would be objective. However, much of science is subjective and is historically built on a small subset of privileged voices.

In 1001X, we will try to acknowledge a diverse group of scientists, but limits still exist on this diversity. It is possible that there may be both overt and covert biases in the material due to the lens with which it was written, even though the material is primarily of a scientific nature. Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

We would like to discuss issues of diversity in science as part of the course from time to time. Please contact us (in person or electronically) or submit confidential feedback if you have any suggestions to improve the quality of the course materials.

Furthermore, we would like to create a learning environment for everyone that supports diverse thoughts, perspectives, and experiences, and honours your identities (including race, gender, gender identity, class, sexuality, religion, ability, etc.). To help accomplish this: If you have a name and/or set of pronouns that differ from those that appear in your official Western records, please let us know. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with us. We want to be a resource for you. Remember that you can also submit confidential feedback (which will lead to us making a general announcement to the class, if necessary, to address your concerns – without identifying you).

If you prefer to speak with someone outside of the course, your academic advisors are an excellent resource. We, like many people, are still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to us about it. Again, your feedback will always be confidential. As a participant in course discussions, you should also strive to honour the diversity of your classmates.

Course Website

News, course updates, and relevant materials will be posted on Western's learning management system, OWL Brightspace (http://owl.uwo.ca). This is the primary method by which information will be disseminated to all students in the class, so you are responsible for checking OWL on a frequent basis.

If you need technical assistance with OWL, seek support on the OWL Help page. Alternatively, contact the Western Technology Services Helpdesk by phone at 519-661-3800 or extension 83800.

Class and Personnel Information

Classes take place at the times and locations specified below.

- Mon and Fri 9:30–11:30 NCB 293
- Wed 9:30–12:30 NCB 293
- Tue and Thu 9:30–12:30 TC 303

Contact information for the course personnel:

Instructor	**Office**	**Email**
Lyudmila Goncharova	PAB 231	lgonchar@uwo.ca
Felix Lee (course coordinator)	MSA 0202	flee32@uwo.ca
Denis Maxwell	NCB 223	dmaxwell@uwo.ca
Gregory Reid	MC 281	reid@uwo.ca
Zahra Sharif (lab supervisor)	CHB 380A	zmohama@uwo.ca
Jeremiah Shuster	BGS 0164	jshuste3@uwo.ca
Kanwal Tanwir	PAB 261	ktanwir@uwo.ca

Remember, we are here to support you! If you find yourself not understanding the lectures, assigned readings, or problems, please come to our scheduled office hours, which will be posted on OWL, or set up an appointment by sending an email **from your Western email account**.

Laboratory and Tutorial Sections

There are up to two laboratory sessions and two tutorial/teamwork sessions per week. The days and times for these sessions depend on your lab/tutorial section. For most (but not all) activities:

Section 002

- Mondays and Wednesdays: laboratory from 1:30–4:30 in CHB 380
- Tuesdays and Thursdays: tutorial/teamwork from 1:30–3:30 in UCC 54A

Section 003

- Tuesdays and Thursdays: laboratory from 1:30–4:30 in CHB 380
- Mondays and Wednesdays: tutorial/teamwork from 1:30–3:30 in UCC 54A

Course Materials

All of the materials below are required. Some of these materials are the same as the ones you had used in the first term. **Laboratory manuals do not need to be purchased.** Experiments, tutorials, exercises, etc. will be available on OWL for download.

1. *CLP Calculus* Textbooks (free) at https://personal.math.ubc.ca/~CLP/
2. *Open Stax Calculus* Volume 2 (free) at https://openstax.org/details/books/calculus-volume-2/
3. *Chemistry 1302B Course Workbook*, 2024–25 edition. It is only available in paper format at the Western bookstore. Old editions may not be used. The cost of the workbook is $78.25.
4. Physics textbook from Physics 1201A or 1501A. Because you should already have this textbook, no additional purchase is required.
5. Proper laboratory attire, including lab coat, safety glasses, pants, socks, and shoes without any openings or holes.
6. Non-programmable scientific calculator (brand or model does not matter)
7. USB flash drive for transferring data from lab computers

Overview of Course Topics – by Question

Integrated Science 1001X takes a different approach to science education by addressing three broad questions, each one of which addresses the learning outcomes found in the traditional, first-year science courses. A non-exhaustive list of the topics in each question is provided below.

1. How did Earth evolve?
    - Evolution of the universe
    - Formation and evolution of planets and atmospheres
    - Rocks, minerals, plate tectonics, and geophysics
    - Evolution of the periodic table
    - Climate change
    - Evolution of life

2. What is energy?
    - Mechanical energy, including wind and water
    - Fossil fuels and combustion
    - Solar energy
    - Electrical energy and magnetism
    - Nuclear energy
    - Photosynthesis and biological energy

3. What is life?
    - Structure, function, and regulation of proteins and nucleic acids
    - Thermodynamics of life and equilibrium processes
    - Cellular metabolism
    - Adaptation to extreme environments
    - Bioinformatics

Because mathematics (especially calculus) is an essential tool in science and in these topics, a certain number of classes has been dedicated to mathematics.

Overview of Course Topics – by Subject

The Faculty of Science considers Integrated Science 1001X to be a substitute for Biology 1002A/B, Calculus 1301A/B, Chemistry 1302A/B, and Physics 1202A/B. Listed below is a non-exhaustive summary of the topics in the four above subject areas that are covered in 1001X.

- Biology
    - Molecular genetics and evolution
    - Proteins: structure, denaturation, enzymes, evolution
    - Membranes: structure, function
    - Photosynthesis, cellular respiration, and bioenergetics
- Calculus
    - Differential equations: an introduction to their solutions and centrality in the sciences
    - Integration techniques
    - Series with constant coefficients and the representation of functions as power series
    - Parametric and polar curves
    - Brief introduction to multi-variable calculus
    - Connections with, and applications in, the various sciences
- Chemistry
    - Gases: ideal gases, gas stoichiometry, kinetic molecular theory
    - Thermodynamics: heat and work, calorimetry
    - Thermochemistry: enthalpy, entropy, free energy
    - Equilibrium: equilibrium constant, solubility, weak acids/bases, buffers
    - Electrochemistry: redox, voltaic cells, electrolytic cells, batteries
    - Kinetics: rates and rate laws, Arrhenius theory, mechanisms
- Physics
    - Energy: units of measurement, laws of thermodynamics, Joule's experiment
    - Electricity: electric fields, point charges and dipoles, potential difference
    - Circuits: voltage, current, Ohm's Law, power, capacitance
    - Waves: simple harmonic motion, wave parameters, energy, superposition
    - Magnetism: motion of charged particles, magnetic flux, Faraday's and Lenz's laws

Evaluation

Breakdown by Subject

The overall course grade will be calculated out of 200 points. The points are divided between various deliverables (such as assignments and lab reports) and assessments (quizzes, tests, and exams), and are allocated to the different subjects as per the table below.

Subject	Deliverables	Assessments	Total
Astronomy	5	4	9
Biology	15	20	35
Chemistry	20	25	45
Earth Sciences	16	5	21
Mathematical Sciences	19	26	45
Physics	23	22	45
Total	**98**	**102**	**200**

The points within each subject are allocated to the three questions, but not necessarily with equal weight. The "Weekly Summary of Points" on page 9 provides more details. The *Master Schedule* on OWL shows the important dates and point values for the various components.

At the end of the term, one grade, expressed as a percentage of the 200 points, will be submitted to the Registrar.

Deliverables

Deliverables include assignments, exercises, lab reports, and all other learning activities *other than* quizzes, tests, and exams.

Most students complete their deliverables before the deadline. If you are unable to complete a deliverable prior to the deadline, you may submit it up to three days late (including weekends and breaks) without penalty and without obtaining academic consideration. After three days, academic consideration will need to be obtained (see section on Late or Missed Coursework), or else a mark of zero will be assigned to the deliverable.

Assessments

Quizzes, midterm tests, and exams are listed below.

- In-class Math quiz on Thursday, January 30, 10:30–12:20
- In-class midterm tests
  - Math on Tuesday, February 25, 9:30–11:20
  - Physics and Astronomy on Wednesday, February 26, 9:30–11:20
  - Chemistry on Thursday, February 27, 9:30–11:20
  - Biology and Earth Sciences on Friday, February 28, 9:30–11:20
- In-class Math quiz on Friday, March 28, 9:30–11:20
- Four 3.0-hour cumulative final exams to be scheduled by the Registrar during the April exam period. The four exams are Biology, Math, Chemistry, and Physics, and they will be at the same time as the exams for Bio 1002B, Calc 1301B, Chem 1302B, and Physics 1202B, respectively. These times will *not* appear on your exam schedule, so we will provide more details as they become available.

Requirements for Passing Course

To obtain credit for 1001X as a whole, all three requirements below must be met:

1. Obtain a minimum of 50% on the overall course grade.
2. Obtain a minimum of 50% on the total of all of the points associated with lab activities.
3. Obtain credit for each of the chemistry, biology, physics, and math components of 1001X, as described below.
   a. Obtain at least 50% of the points allocated to the subject itself.
   b. Obtain at least 50% of the points associated with the laboratory activities in that subject, if that subject has laboratory activities.
   c. Miss, whether excused or not, no more than one-third of the laboratory activities associated with the subject, if that subject has laboratory activities.

Students who fail to meet requirement #2 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X.

Students who fail to meet requirement #3 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for 1001X. However, these students may take, in the summer of 2025, the “traditional” first-year course that most closely aligns with the subject for which credit in 1001X was not obtained. The grade obtained in the traditional course will be used to calculate a new 1001X grade. The eligible traditional courses are Chem 1302B, Physics 1202B or 1502B, Calculus 1301B or 1501B, and Biology 1002B.

Tentative Weekly Summary of Points

Week	Item	Discipline(s)	Total Points
1 Jan 6	Tutorials: Skills and Applications	All	6
2 Jan 13	Lab 1: Exoplanets	Astronomy	2
	Tutorial: SHM and Waves	Physics	1
	Lab 2: Minerals	Earth Sci	2
	Tutorial: Math	Math	1
	Assignment: Math	Math	2.5
3 Jan 20	Lab 3: Rocks	Earth Sci	2
	Assignment: SHM and Waves	Physics	2
	Tutorial: Electricity and Circuits 1	Physics	1
	Tutorial: Electricity and Circuits 2	Physics	1
	Tutorial: Gases and Solubility	Chem	1
4 Jan 27	Tutorial: Excel activity	Math and Earth Sci	1
	Tutorial: Math	Math	1
	Assignment: Electricity	Physics	2
	Lab 4: Alternative Energy	Physics and Chem	2.5
	Quiz: Math	Math	3
	Case Study: Habitable Planets	All	3.5
5 Feb 3	Lab 5: Simple Harmonic Motion	Earth Sci and Physics	2
	Tutorial: Math	Math	1
	Lab 6: Calorimetry	Chem	2
	Assignment: Circuits	Physics	2

6 Feb 10	Lab 7: Circuits	Physics	2.5
	Tutorial: Energy	Chem	1
	Lab 8: Battery	Chem	2
	Tutorial: Chem Review	Chem	1
	Assignment: Anthropocene	Earth Sci	2
	Assignment: Math	Math	2.5
Reading week			
7 Feb 24	Midterm: Math	Math	8
	Midterm: Physics and Astronomy	Physics and Astronomy	11
	Midterm: Chem	Chem	10
	Midterm: Biology and Earth Sci	Biology and Earth Sci	10
8 Mar 3	Labs 9 and 10: Integrated Metabolism (due week 12)	Biology	6
	Tutorial: Electricity Integrals	Physics	1
	Tutorial: Math	Math	1
	Assignment: Math	Math	2.5
9 Mar 10	Assignment: Oil	Earth Sci	2
	Assignment: Electricity Integrals	Physics	2
	Tutorial: Int. Metabolism Data/Report	Biology	1
	Tutorial: Electrochem	Chem	1
	Lab 11: Magnetometer (due week 11)	Earth Sci	3
	Tutorial: Equilibrium and Acid/Base	Chem	1
	Assignment: Nuclear Energy	Earth Sci	1

10 Mar 17	Case Study: Alternative Energy	All	3
	Lab 12: Polarimetry	Chem and Biology	2
	Tutorial: Magnetic Fields	Physics	1
	Lab 13: Wine and Buffers	Chem	2
	Tutorial: Math	Math	1
11 Mar 24	Assignment: Magnetism	Physics	2
	Lab 14: Enzyme Kinetics	Chem and Biology	2
	Tutorial: Kinetics	Chem	1
	Lab 15: Protein Folding	Biology	2
	Tutorial: Electromagnetism	Physics	1
	Quiz: Math	Math	3
12 Mar 31	Tutorial: Buffers	Chem	1
	Tutorial: Bioinformatics	Biology	1
	Assignment: Math	Math	2.5
	Case Study: Definition of Life	All	3.5
Various	iClicker component Participate in at least 50% of the questions to receive 1.0. Academic consideration is not needed for missed questions. The 50% requirement accounts for occasional missed classes. Contact the instructor if extenuating circumstances result in missing more than 50% of the questions.	Chem Math	1.0 1.0
Final Exam Period	Chem	Chem	15
	Biology	Biology	15
	Physics	Physics	15
	Math	Math	12
		Total	**200**

Accommodation, Accessibility, and Support Services

Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Students with disabilities are encouraged to contact Accessible Education (http://academicsupport.uwo.ca/accessible_education/index.html), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The university's policy on Accommodation for Students with Disabilities can be found here: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Advising or Dean's Office of their home faculty or affiliated college. Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays: https://www.edi.uwo.ca

Students who are in emotional/mental distress should refer to Health and Wellness (https://www.uwo.ca/health) for a list of options about how to obtain help.

Additional student-run support services are offered by the USC, http://westernusc.ca/services.

Academic Policies and Legalities

The use of generative artificial intelligence (AI) tools/software/apps is unacceptable in this course.

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Audience response systems ("clickers") may be used to collect information during class. The data collected using the devices will not be used for research purposes without your consent.

Aside from a non-programmable scientific calculator, no other electronic devices (phones, smartwatches, etc.) may be in your possession during tests and exams, even for timekeeping purposes. They may not be at your test/exam desk or in your pocket. Any student found in possession of these prohibited devices will receive a mark of zero on the test or exam.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Computer-marked, multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

Tests and examinations in this course are in-person assessments. In the event that one or more of these assessments need to be conducted online due any university-declared emergency, they may be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

Late or Missed Coursework

Most students in the course follow all deadlines and participate in all learning activities and assessments, which are all strategically designed and scheduled for optimum learning.

Your instructors realize that occasionally, students may experience an extenuating circumstance of significant severity (such as illness or injury) that temporarily renders them unable to meet academic requirements.

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

This policy does not apply to requests for academic consideration submitted for attempted or completed work, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education at: http://academicsupport.uwo.ca/accessible_education/index.html

For procedures on how to submit academic consideration requests, please see the information posted on the Office of the Registrar's website at:
https://registrar.uwo.ca/academics/academic_considerations/

All requests for academic consideration must be made within 48 hours after the assessment date or submission deadline.

- If you are a Science or Basic Medical Sciences student, information on academic considerations (as well as adding/dropping courses, appeals, exam conflicts, and many other academic-related matters) can be found at: website: https://www.uwo.ca/sci/counselling/

All academic consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make *one* academic consideration request without supporting documentation in this course. However, the all four Midterm Tests and Final Exams are excluded from this, and therefore always require formal supporting documentation.

When a student *mistakenly* submits their one allowed academic consideration request without supporting documentation for the assessments listed above or those in the coursework with built-in flexibility below, the request cannot be recalled and reapplied. This privilege is forfeited.

Because the following components already have built-in flexibility, academic consideration requests will be denied for these:

- Deliverables, such as assignments and lab reports no more than three days late (automatic three-day extension without penalty)
- iClicker Questions (only 50% participation required)
- Tutorials

A summary of the procedures for the different course components is provided below.

Late Deliverable

Deliverables, such as assignments and lab reports, submitted up to three days late will be marked without penalty. If your deliverable is more than three days late, please obtain academic consideration. Your late deliverable will then be marked as though it were submitted on time.

Missed Tutorial

Most students find that the tutorials are an incredible opportunity to learn and work together as a team. On the rare occasion that you are unable to attend a tutorial, it is not necessary to obtain academic consideration. You must, however, contact the instructor and explain your circumstances without divulging information that you deem private.

For participation-based tutorials where there is a submission at the end of the tutorial, you will be given the participation mark. Graded tutorials will be reweighted within the same subject.

Missed Lab Session

Labs are the most fun part of science, but if you cannot attend a lab session, please obtain academic consideration.

There are no make-up labs, and it is not possible to reschedule them. If academic consideration has been approved, the other labs within the same subject as the missed lab will be reweighted.

Students are still responsible for the theoretical content associated with the missed lab.

Missed Math Quiz

Please obtain academic consideration.

If Math Quiz #1 is missed, a make-up will be available. If Math Quiz #2 is missed, its weight will be shifted to the Math Final Exam.

Missed Midterm Test

Please obtain academic consideration. Supporting documentation is always required for a missed Midterm Test.

You will then be able to write a make-up test at a later date. If you are unable to write a make-up test, the weight of the missed test will be shifted to the subject-specific Final Exam.

Missed Final Exam

Please obtain academic consideration. Supporting documentation is always required for a missed Final Exam. After approval, you will be able to write a Special Exam in May.

You may also be eligible to write a Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

This course is supported by the Science Student Donation Fund. If you are a student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Advising site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the Chair of the Department or email the Science Students' Council at ssc@uwo.ca.