Yukon University	**School of Science**
	CHEM 110 **The Structure of Matter**
	Term: Fall 2025 **Number of Credits: 3**

Course Outline

INSTRUCTOR: Ernie Prokopchuk, PhD (He/Him)
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Phone: 668-8865

OFFICE: A2015
OFFICE HOURS: Tues & Fri 12:30-2:00 pm
or any time my door is open or by appointment

CLASS: Mon & Wed 10:30 am -12:20 pm
ROOM: TBD

LAB: Tuesday 2:30-5:20 pm
ROOM: A2803

COURSE DESCRIPTION

This course covers both the common practical aspects of chemistry as well as the theoretical principles that describe this science. Topics of study include the structure of the atom, electron configuration, the nature of chemical bonding and a look at liquids, solids and gases at a molecular level. Other topics of study include reaction stoichiometry and an introduction to organic chemistry and biochemistry. Lab sessions illustrate and reinforce most of the topics presented in the lectures.

Successful completion of this course and its companion CHEM 111 will satisfy the requirement for 6 credits of first year chemistry in the science programs at most Canadian and US universities.

COURSE REQUIREMENTS

Prerequisite(s): Chemistry 11 (CHEM 050). Chemistry 12 (CHEM 060) is strongly recommended.
Corequisite(s): Mathematics 12 (MATH 060)

I do expect that you are coming into this course with a basic understanding of simple nomenclature (chemical naming and formula writing), stoichiometry (equation balancing and chemical calculations) and basic atomic structure. It is alright if you feel a bit rusty with some of these concepts, as we will very briefly review these in class. If you have any concerns about your level of preparation, please let me know and we can figure out what, if any, additional review would be helpful.

EQUIVALENCY OR TRANSFERABILITY

Receiving institutions determine course transferability. Find further information at:
https://www.yukonu.ca/current-students/transfer-credit

LEARNING OUTCOMES

Upon successful completion of this course, students will:

- have further developed their critical thinking skills
- be able to discuss chemical concepts, theories, and examples of fundamental chemistry
- have developed basic hands-on laboratory skills in experimental investigation of chemical questions

COURSE FORMAT

Weekly breakdown of instructional hours

Three hours lecture, one hour tutorial (incorporated into the lectures), three hours lab. It is likely that you will need about 4 – 6 hours/week (on average) for homework, readings, and studying for the lecture component and 4 – 5 hours/week for readings, prelabs, and reports for the lab component. These are average estimates and the actual time you need may differ.

Delivery format

Classes are delivered in-person (face-to-face) as a blend of lecture and tutorial allowing for an opportunity to practice solving calculation-based problems related to the material being covered in class.

I will record classes in order to provide you with a way to revisit material covered in class. This may be helpful while studying, to review a topic covered in class, or to fill in a gap in your notes. This also provides greater flexibility to anyone who is unable to make the occasional class due to work, family commitments, or other reasons, but please note that these recordings are *not intended to be a substitute for regular class attendance*. If the technology fails, recordings may not be available for a given day. The videos will only be available on the course Moodle page, accessible only to registered students and select university staff.

I will regularly post material on the course LMS (Moodle) page. This material will include links to lecture capture videos, pdfs of the notes written on the screen, assignments, course announcements, links to content in the online textbooks, suggested practice problems, and other useful or interesting material related to the course. Please be aware that all course announcements and any other notifications generated by Moodle are sent to your Yukon University email address. It is essential that you regularly check this email account or set it to automatically forward to your preferred email account.

Labs are a mandatory component of the course. You are expected to attend all lab sessions, complete the experiments, and submit the required reports. Something may come up to prevent you from attending a lab. If this happens, please let me know as soon as possible (before the lab is even better) so we can determine the best solution. You cannot submit a report for the missed lab unless we have already made arrangements for that. The lab grade will be determined based on lab quizzes, pre-lab exercises, lab performance, and the lab reports. Expectations for the labs are outlined in the lab manual.

EVALUATION

Assignments	10 %
Term Test 1 (60 minutes)	15 %
Term Test 2 (60 minutes)	15 %
Final Exam	30 %
Laboratory	30 %
Total	100%

You are required to pass both the laboratory component (15/30) and the lecture component (35/70) in order to pass the course

Attendance

While attendance is not graded, I strongly recommend regular attendance. There is a strong correlation between regular attendance and academic performance, but this must also be balanced with your own health and well-being. If you miss a class due to illness or some other commitment, the posted videos and notes can be helpful, and I am always willing to answer any questions you may have about the missed content.

Assignments

There will be at least 8 assignments due on an approximately weekly basis. Assignments are worth 10% of the final grade based on the total mark obtained on all assignments. Assignments will involve a variety of questions or problems related to the course material. These provide you with an opportunity to get some practice with the concepts, and feedback on your understanding of the material. You will have at least one week to complete each assignment. I will accept and grade assignments after the due date and up to the moment when I return marked assignments to the class. Any assignment submitted after that point will usually receive a mark of 0 (but I will provide corrections/feedback) though I am willing to consider the specific situation and possibly grant an extension for exceptional circumstances (health, family emergency, cultural practices, etc).

Tests and Examinations

There will be two 60-minute term tests (October 8, 2025 and November 12, 2025) held during scheduled class time. Each test is worth 15% of the final grade. Please note that after a term test the remaining class time will be used for a lesson. The final examination (TBD - during the exam period Dec 11-20), worth 30% of the final grade, will cover material from the entire course, potentially including some content from the lab.

Laboratory component

The laboratory component of the course is worth 30% of the final grade. This will be based on lab performance (10%), pre-lab assignments (10%), lab quizzes (5%), and lab reports (75%). The specific evaluation criteria for the lab are detailed in the lab manual.

COURSE WITHDRAWAL INFORMATION

If you find yourself struggling with the course at any point in the semester, please come and see me. For many students, a bit of extra help is enough to succeed in this course. However, if your current circumstances are such that a withdrawal, or converting to audit, is the best option for you, you have until October 31, 2025 to do so without academic penalty.

TEXTBOOKS & LEARNING MATERIALS

As a step to making education more affordable, we will be using OpenStax and LibreTexts as our textbooks. The OpenStax materials include a student solution guide to the textbook problems (free login required). Some copies of traditional textbooks will be placed on reserve in the library.

You will need access to a computer or other suitable device, as internet access is required for this course.

The Laboratory Manual for Chemistry 110 will be provided. You will need to provide your own notebook for use as a Lab Notebook. This must be a separate bound notebook, not the one you are using for course notes. More information will be provided in the first lab session.

Students will need to provide their own safety glasses that are ANSI Z87.1 (or later) or CAS 94.1 (or later) certified; this information will be on the packaging. These are the same kind of safety glasses required in the Trades and can be purchased wherever such safety equipment is sold. If your safety glasses have coloured lenses, they must not inhibit your ability to see clearly in the lab.

Lab coats are mandatory, and should be purchased ahead of time. Cotton lab coats are best, but most expensive. Blends are acceptable but 100% polyester must be avoided as it is quite flammable. Also, if buying a lab coat online, please be sure it is a real lab coat and not a costume item which will not provide adequate protection.

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures for further details about academic standing and student rights and responsibilities.

Note that generative artificial intelligence tools such as Chat GPT can be useful in the same way as a web search or Wikipedia. They can be a starting point but cannot be used to do the work for you. Simply copying the output from something like Chat GPT and submitting it as your own work will be considered plagiarism the same as if you copied directly from a book, webpage, or classmate. Furthermore, appropriate referencing is expected in submitted work. If generative AI is used as part of your writing workflow, this must be indicated either as a footnote or endnote describing the use/purpose of the AI. Please be aware that generative AI cannot be used as a reference source itself. Chat GPT and similar tools

are not actual sources of information and should not be referenced as such, much as you would not reference the results of a web search. References should be to the published scientific literature, or, when appropriate, to the popular scientific media.

ACCESSIBILITY AND ACADEMIC ACCOMMODATION

Yukon University is committed to providing a positive, supportive, and barrier-free academic environment for all its students. Students experiencing barriers to full participation due to a visible or hidden disability (including hearing, vision, mobility, learning disability, mental health, chronic or temporary medical condition), should contact Accessibility Services for resources or to arrange academic accommodations: access@yukonu.ca.

TOPIC OUTLINE

Week	Unit	Topic
1 2	1	Fundamental concepts (review) - Atoms, molecules, compounds, empirical formulas - Measurements, moles, solution concentration and dilution - Chemical equations, stoichiometry, yields
2 3	2	Behaviour of gases - Ideal gas law, gas mixtures, stoichiometry - Molecular view of gases - Gas density, rates of movement - Real gases - Atmospheric chemistry
4	3	Atoms and light - Characteristics of atoms and light - Absorption and emission spectra - Properties of electrons, quantization, particle in a box, and quantum numbers - Shapes of atomic orbitals
5	4	Atomic energies and periodicity - Orbital energies - Electron configurations - Periodicity of atomic properties - Ions and ionic compounds
6	5	Fundamentals of chemical bonding - Bond length, electron sharing, polarity - Lewis structures and molecular shapes - Covalent bond properties
7	6	Theories of chemical bonding - Localized models, hybridized orbitals, multiple bonds

		- Molecular orbital theory - Resonance, delocalized π systems
8 9	7	Organic chemistry structures - hydrocarbon structures, nomenclature - aromatic compounds - alkyl halides, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids, esters, amides, nitriles - stereochemistry
9 10	8	Organic chemistry reactions - nucleophiles, electrophiles, mechanisms - substitution reactions - elimination reactions - addition reactions
11	9	Solids - lattice structures - Band theory of solids
12	10	Intermolecular forces - melting and boiling points - types of forces - properties of liquids - phase changes
13	11	Properties of solutions - solubility - colligative properties - colloids, suspensions, surfactants

**Specific dates of topic coverage may be subject to change. Some topics may not be covered depending on time constraints.*