Yukon University	**School of Science**
	CHEM 110 **The Structure of Matter**
	Term: Fall 2024 **Number of Credits: 3**

Course Outline

INSTRUCTOR: Ernie Prokopchuk, PhD
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Phone: 668-8865

OFFICE: A2015
OFFICE HOURS: Wed & Fri 1:30-3:00 pm
or any time my door is open or by appointment

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

LAB: Thursday **or** 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)

Students are expected to come to this course with an understanding of basic nomenclature (chemical naming and formula writing), stoichiometry (equation balancing and chemical calculations) and simple atomic structure. This material will only be briefly reviewed during the first week of class. If you feel a bit rusty on these subjects you are strongly advised to see the instructor prior to the start of the course.

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 expected that this course will require 4 – 6 hours/week (on average) of homework, readings, and studying for the lecture component and 4 – 5 hours/week for readings, prelabs, and reports for the lab component. The actual time required will depend on the individual and some may need more or less time than these estimates.

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.

Classes will be recorded with the intent to provide students with a way to revisit material covered in class. This may be helpful while studying or to review a topic covered in class. This also provides greater flexibility to students who are unable to make the occasional class due to work, or other commitments, 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. Videos will only be available via the course Moodle page and only to students registered in the course.

Material will regularly be posted on the course LMS, Moodle. This material will include links to lecture capture videos, assignments, course announcements, links to content on LibreTexts and/or the open access OpenStax textbook, suggested practice problems, a pdf of everything written on the screen during class, 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. Students are expected to attend all lab sessions, complete the experiments, and submit the required reports. If a lab period is missed, the report for that experiment cannot be submitted unless arrangements are made with the instructor. 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%

Students must 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, it is strongly recommended. There is a strong correlation between regular attendance and academic performance.

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. You will have at least one week to complete each assignment. Late assignments will not be accepted (receiving a mark of 0) once graded assignments have been returned to the class, which usually happens at the next class.

Tests and Examinations

There will be two 60-minute term tests (October 9, 2024 and November 6, 2024) held during scheduled class time. Each test is worth 15% of the final grade. Please note that after the term tests the remaining class time will be used for a lesson. The final examination will be held between December 12 and 19, 2024 (exact date/time to be determined), 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

The final day to withdraw without academic penalty is November 4, 2024.

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 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. These MUST be clear (not tinted) and 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.

Lab coats are mandatory, and students should be purchased ahead of time. Cotton lab coats are best, but most expensive. Blends are acceptable but 100% polyester must be avoided as these are quite flammable.

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. Generative AI cannot be used as a reference source. 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.*