COURSE SYLLABUS

COURSE TITLE: CHEM-150-Engineering Chemistry
CLASS SECTION: X01A, X01B, X02A, X02B

TERM: 2025W

COURSE CREDITS: 3

DELIVERY METHOD(S): face to face, lecture and lab

Camosun College respectfully acknowledges that our campuses are situated on the territories of the Lək̓ʷəŋən (Songhees and Kosapsum) and WSÁNEĆ peoples. We honour their knowledge and welcome to all students who seek education here.

INSTRUCTOR DETAILS

NAME: Daniel Dönnecke

EMAIL: donnecked@camosun.bc.ca

OFFICE: Interurban Campus, Tec 232

HOURS: Thursday 11:30-12:20

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

Topics include thermochemistry, atomic and molecular structure, chemical bonding, gases, liquids and solids, solutions and phase equilibria, equilibrium, chemical thermodynamics and electrochemistry.

PREREQUISITE(S):

Although Camosun has no high school chemistry prerequisite for CHEM 150, UVIC and UBC do. It is strongly recommended that students have Chem 11 or equivalent. We will be reviewing basic concepts in the first week or two but quickly move on, covering first year university material in depth. There is a CHEM 150 Review Package in the Bookstore that you can purchase. It is Camosun's in-house Chem 11 course material which students with only Science 10 background might find helpful for the review session.

CO-REQUISITE(S):

EQUIVALENCIES:

COURSE LEARNING OUTCOMES / OBJECTIVES

Upon completion of this course students will be able to:

Calculate outcomes of chemical reactions based on stoichiometric quantities in general and in aqueous solutions in particular.

Describe the electronic configuration of atoms and explain why some atoms have unusual configurations.

Determine the shape and symmetry of molecules based on atomic, molecular, and hybrid orbitals.

Explain the impacts of bond polarity on molecular interactions on the physical states (phases) of molecules.

Determine the properties of polymers, ceramics and other engineering materials based on bonding and molecular interactions.

Calculate the properties of ideal gases. Describe the differences between ideal and non-ideal gases.

Calculate physical properties of solutions.

Determine rate constants, order of reaction and activation energy for simple chemical reactions.

Determine concentrations of participating molecules in chemical equilibria, in particular, aqueous equilibria. Determine the pH of dilute aqueous solutions of acids and bases.

Explain the importance of total energy, enthalpy, entropy and free energy in chemical processes.

Balance redox reactions. Determine the voltages of simple electrochemical cells. Describe the role of electrochemistry in corrosion and corrosion control.

Use orbital theory to describe the properties of metals and semiconductors.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

(a) Texts: No text is required, but it is strongly recommended that you have a first-year university chemistry text, either used or from the library. The following are suitable chemistry books (older editions are fine too).

General Chemistry, *Petrucci* (excellent book), Chemistry the Central Science, *Brown Le May* (good book but a bit weak on quantum mechanics)

(b) Other: The lab Manual will be available online (D2L). Print it and bring it to each lab. It contains procedures for the experiments you are conducting. Come prepared. Having read and understood the procedures for the upcoming lab will greatly enhance your lab experience. The importance of the lab component cannot be overstated. I try to correlate the lab with the lecture as much as possible. You also need to bring a pair of safety glasses. You will not be allowed in the lab without safety glasses. A lab coat is recommended.

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

WEEK or DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
1	*Lab 0* Safety in the Chemistry Lab	
2	*Lab 1* Densities	
3	*Lab 2* Stoichiometry January 24th **Review Test** (50 min, during lecture time)	
4	*Lab 3* Spectroscopic Determination of Nickel	
5	*Lab 6* Copper; corrosion and recycling of copper	
6	February 14th **Term Test 1** (50 min, during lecture time) *Lab 4* Shape of Molecules and Polarity	
7	**17 February, Family Day, College closed** **18 February - 21 February Reading Break**	
8	*Lab 5* Distillation	
9	**Midterm** (90 min, during lab time)	
10	*Lab 7* Thermochemistry	
11	*Lab 8* Bromination of Acetone	
12	*Lab 9* Determination of Chloride March 28th **Term Test 2** (50 min, during lecture time)	
13	*Lab 10* Atomic Absorption Spectroscopy	
14	*Lab 11* Quantum demonstrations during the lab period	
15	14 April, Final Exam Period begins **18 April, Good Friday, College closed**	

Detailed Lecture Outline (approximate):

Week 1-2 Review: Foundations of chemistry including Matter, Daltons atomic theory, fundamental particles, isotopes, atomic weights, ionic bonding, ionization energy, Electron Affinity, Metals, Non-metals, Octet rule, covalent bonding, Lewis structures of simple molecules and ions. Nomenclature of ionic and molecular compounds including acids. Stoichiometry and solution stoichiometry.

Week 2-3: The shape of molecules, Lewis structures of molecules and ions: part (II), Resonance Hybrids, formal charges, Valence Shell Electron Pair Repulsion Theory, exception to the octet rule, odd electron species, electron deficient compounds, expanded valence shell.

Week 4-5: Electronegativity, polar covalent bonds, polarity and shape of molecules, resultant Dipole moment, Intermolecular forces, dipole-dipole, induced dipole-induced dipole, polarizability and shape of molecules, hydrogen bonding, boiling point, melting point, surface tension, viscosity, vapour pressure, phase diagram,

Week 6-7: Colligative Properties (Raoult's Law, Osmosis and Osmotic pressure) Gases: Units of pressure, Boyle's law, Charles's law, Avogadro's law, ideal gas law, Daltons law of partial pressure, gas stoichiometry, Kinetic molecular gas theory, effusion, diffusion, real gasses, Van der Waals equation, Joule-Thomson effect.

Week 7-8: Thermochemistry, work and heat, systems and surroundings, first law of thermodynamics, Internal energy, state functions, enthalpy of reaction, 2^{nd} law of thermodynamics, heat capacities, Hess law, enthalpies of formation, entropy, spontaneous processes, irreversible processes, third law of thermodynamics. Gibbs free energy.

Week 8-9: Electrolytes, Dissociation and Ionization, pH of strong and weak acids and bases, pH of salt solutions, buffers, molecular structure and acid base behaviour.

Week 10: Electrochemistry: Voltaic cells, electromotive force, standard cell potential, standard hydrogen electrode, electrochemical series, Nernst equation, concentration cell, pH-meter, common batteries, fuel cell, corrosion, anodizing, electroplating, sacrificial anode, electrolytic cells

Week 11: Introductory Quantum Mechanics: electromagnetic radiation, photoelectric effect, Planks equation, dual nature of light, De Broglie relationship, Heisenberg's uncertainty principle, Wave mechanics, wave functions and standing waves, Schrodinger equation, Particle in a box, quantization of energy, probability and electron charge density, wave functions for the hydrogen atom, atomic orbitals, quantum numbers, multi electron atoms, electron configuration and the periodic table, Pauli exclusion principle, Hund's rule, para and diamagnetism.

Week 12-14: Advanced bonding models: Valence-bond method: sp^3, sp^2 and sp hybrid orbitals. Strengths and limits of VB method. MO theory: constructive and destructive interference of wave functions, Bonding and anti-bonding molecular orbitals, MO-diagrams' for homonuclear diatomic species of the first and second period up to Z =10, Paramagnetism of dioxygen. Band theory, conductors, insulators and semiconductors, band gap of group 14 elements, doping, LED and photo voltaic cells, thermal properties of semiconductors.

Lectures:	Section X01A and X01B	
	Mo 13:00-14:20 in **CBC 220**, Wed 11:30-12:20 in **CBA 220** and Fr 10:30-11:50 in **TEC 181**	
	Sections X02A and X02B	
	Mo 10:30-11:20 in **TEC 174**, Tue 8:30-9:50 in **TEC 174** and Fr 8:30-9:50 in **CBA 101**	
Laboratory:	Sections X01A Friday	13:00 - 15:20 **Tec 230**
	Sections X01B Tuesday	12:30 - 14:50 **Tec 230**
	Sections X02A Thursday	12:30 - 14:50 **Tec 230**
	Sections X02B Thursday	8:30 - 10:50 **Tec 230**

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines can be reviewed on the CAL exams page. https://camosun.ca/services/academic-supports/accessible-learning/academic-accommodations-exams

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Lab	20 %
Review Test	7 %
Term Test 1	10 %
Midterm	18 %
Term Test 2	10 %
Final Exam	35 %
TOTAL	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the Grade Review and Appeals policy for more information.

http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf

COURSE GUIDELINES & EXPECTATIONS

Problem sets which will prepare you for exams will be provided on D2L (approximately biweekly). These problem sets are not graded but answer keys will be posted on D2L. A 50 min review test covering basic topics of chemistry such as atomic structure, chemical nomenclature and stoichiometry (which will be reviewed during the first week and a half) will be written during lecture time of week three. Two 50 min Term Tests, worth 10 % each, will be written during lecture time during week 6 and 12. Topics for both tests will be announced in class. A midterm, written during lab time of week 9, will cover material from week 1 to week 8 of the course. A 3 - hour final examination will cover material from week 1 to week 14.

Attendance in the lab is mandatory. If you miss more than two labs unexcused you have failed the lab. You must pass both the lab and the lecture component separately to pass the course. You must also pass the final exam to pass the course. A lab that is missed, an exam that is not written or a lab report that is not handed in, within the beginning of the following lab period, counts as zero towards your course grade. Exceptions can be made if a valid excuse is produced in writing to the instructor (such as a note from a medical doctor) as soon as possible. It is important to let me know what is happening. **Send me an e-mail if you cannot attend a lab or an exam**.

SCHOOL OR DEPARTMENTAL INFORMATION

Chair of the chemistry department is John Lee

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit http://camosun.ca/students/.

Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop

Financial Aid and Awards	http://camosun.ca/financialaid
Help Centres (Math/English/Science)	http://camosun.ca/help-centres
Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration
Technology Support	http://camosun.ca/its
Writing Centre	http://camosun.ca/writing-centre

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Integrity

Students are expected to comply with all College policy regarding academic integrity; which is about honest and ethical behaviour in your education journey. The following guide is designed to help you understand your responsibilities: https://camosun.libguides.com/academicintegrity/welcome
Please visit https://camosun.ca/sites/default/files/2021-05/e-1.13.pdf for Camosun's Academic Integrity policy and details for addressing and resolving matters of academic misconduct.

Academic Accommodations for Students with Disabilities

Camosun College is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging appropriate academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a documented disability and think you may need accommodations, you are strongly encouraged to contact the Centre for Accessible Learning (CAL) and register as early as possible. Please visit the CAL website for more information about the process of registering with CAL, including important deadlines: https://camosun.ca/cal

Academic Progress

Please visit https://camosun.ca/sites/default/files/2023-02/e-1.1.pdf for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit https://camosun.ca/sites/default/files/2021-05/e-2.2.pdf for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit https://camosun.ca/registration-records/tuition-fees#deadlines.

Grading Policy

Please visit https://camosun.ca/sites/default/files/2021-05/e-1.5.pdf for further details about grading.

Grade Review and Appeals

Please visit https://camosun.ca/sites/default/files/2021-05/e-1.14.pdf for policy relating to requests for review and appeal of grades.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal (see Medical/Compassionate Withdrawals policy). Please visit https://camosun.ca/services/forms#medical to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence Policy: https://camosun.ca/sites/default/files/2021-05/e-2.9.pdf and camosun.ca/services/sexual-violence-support-and-education.

To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-370-3841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive,

and safe learning environment. Please review Camosun College's Student Misconduct Policy at https://camosun.ca/sites/default/files/2021-05/e-2.5.pdf to understand the College's expectations of academic integrity and student behavioural conduct.

Looking for other policies?

The full suite of College policies and directives can be found here: https://camosun.ca/about/camosun-college-policies-and-directives

Changes to this Syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.