CAMOSUN COLLEGE	**School of Arts & Science** **CHEMISTRY AND GEOSCIENCE DEPARTMENT** **CHEM 150-X01** **Engineering Chemistry** **Quarter 02/2016**

COURSE OUTLINE

The course description is online @ http://camosun.ca/learn/calendar/current/web/chem.html

Ω *Please note: the College electronically stores this outline for five (5) years only.*
*It is **strongly recommended** you keep a copy of this outline with your academic records.*
You will need this outline for any future application/s for transfer credit/s to other colleges/universities.

1. Instructor Information

(a)	Instructor:	Hugh Cartwright		
(b)	Office Hours:	TBA		
(c)	Location:	TBA		
(d)	Phone:		Alternative Phone:	
(e)	Email:	CartwrightH@camosun.bc.ca		
(f)	Website:	http://web.uvic.ca/~hughcart/chem150w2016/chem150resources.html		

2. Intended Learning Outcomes

(No changes are to be made to these Intended Learning Outcomes as approved by the Education Council of Camosun College.)

Upon completion of this course the student will be able to:

1. Calculate outcomes of chemical reactions based on stoichiometric quantities in general and in aqueous solutions in particular.
2. Describe the electronic configuration of atoms and explain why some atoms have unusual configurations.
3. Determine the shape and symmetry of molecules based on atomic, molecular and hybrid orbitals.
4. Explain the impacts of bond polarity on molecular interactions on the physical states (phases) of molecules.
5. Determine the properties of polymers, ceramics and other engineering materials based on bonding and molecular interactions.
6. Calculate the properties of ideal gases. Describe the differences between ideal and non-ideal gases.
7. Calculate physical properties of solutions.
8. Determine the rate constant, order of reaction and activation energy for simple chemical reactions.
9. Determine concentrations of participating molecules in chemical equilibria, in particular, aqueous equilibria. Determine the pH of dilute aqueous solutions of acids and bases.
10. Explain the importance of total energy, enthalpy, entropy and free energy in chemical processes.
11. Balance redox equations. Determine the voltages of simple electrochemical cells. Describe the role of electrochemistry in corrosion and corrosion control.
12. Use orbital theory to describe the properties of metals and semiconductors.

3. Required Materials

(a) No textbook is required, since some notes will be provided on the web site for the course. Nevertheless, you are advised to use a first year university chemistry text for reference and to supplement these notes and the lectures. The text may be new, but a used copy of one borrowed from the library should also be suitable. *General Chemistry* by Petrucci (one copy is in the reserved reading room) is good, as is *Chemistry, The Central Science* by Brown, Le May et al.

(b) The Chemistry 150 lab manual, which contains experimental procedures for every experiment, is available on D2L. Print it out and bring it to every laboratory session. Reading the instructions in advance will both save you time and contribute to safe working. **You must bring safety glasses and a lab coat to each lab session**. If you do not bring safety glasses you will not be allowed into the laboratory (and therefore will get a mark of zero for that week's experiment).

4. Course Content and Schedule, Section X01

Lectures: Monday 2.30 – 3.20 Tech 173
Tuesday 9.30 – 11.20 Tech 173
Wednesday 2.30 – 3.20 Tech 173
Thursday 8.30 – 9.20 Tech 173
Laboratory: Wednesday 8.30 – 11.20 Tech 230

Lecture schedule (details and ordering subject to change)

Week 1: Review: Foundations of chemistry. What is chemistry? Matter, elements, compounds and mixtures, metals and non-metals, Daltons atomic theory, atoms and molecules, fundamental particles and atomic structure, evidence for atoms, atomic weights, isotopes,

Week 2: Review: stoichiometry and solution stoichiometry, bonding and trends in properties. Ionic bonding, ionization energy, Electron Affinity, Octet rule, covalent bonding, Lewis structures of simple molecules and ions. Nomenclature of ionic and molecular compounds including acids.

Week 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, coordinate covalent bond.

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

Week 5: 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 6: Thermochemistry, work and heat, systems and surroundings, first law of thermodynamics, Internal energy, state functions, enthalpy of reaction, second law of thermodynamics, heat capacities, Hess law, enthalpies of formation, entropy, spontaneous processes, irreversible processes, third law of thermodynamics. Gibbs free energy.

Week 7: Electrolytes, Dissociation and Ionization, pH of strong and weak acids and bases, pH of salt solutions, buffers, molecular structure and acid base behaviour.

Week 8: Electrochemistry: Voltaic cells, electromotive force, standard cell potential, standard hydrogen electrode, electrochemical series, Nernst equation, concentration cell, pH-meter, lead acid battery, dry cell, fuel cell, corrosion, anodizing, electroplating, sacrificial anode.

Week 9: 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 10: 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.

Week 11: Organic chemistry, important functional groups, important polymers, structure and properties of polymers, composite materials.

Preliminary Laboratory and examination schedule:

Week 1, Jan 06: Lectures instead of laboratory experiment
Week 2, Jan 13: Lab 1 Densities
Week 3, Jan 20: Lab 2: Stoichiometry. Review test (50 minutes, during lecture time)
Week 4, Jan 27: Lab 3: Spectroscopic determination of nickel
Week 5, Feb 03: Lab 5: Distillation. Term test 1 (50 minutes, during lecture time)
Week 6, Feb 10: Lab TBA
Week 7, Feb 17: No labs. Midterm test (90 minutes, time and place TBA)
Week 8, Feb 24: Lab 4: Thermochemistry
Week 9, Mar 02: Lab 7: Bromination of acetone
Week 10, Mar 09: Lab 6: Determination of chloride. Term test 2 (50 minutes, during lecture time)
Week 11, Mar 16: Review of course materials during lab time.
Week 12: Final examination period

5. Basis of Student Assessment (Weighting)

The course mark will be calculated as follows:

Review test	7%	Term tests (two)	10% each
Midterm test	18 %	Lab work	20%
Final exam	35 %		

Problem sets, completion of which will prepare you for the exams, will be provided approximately biweekly. These will not be marked or graded, but answer keys will be posted online

A 50-minute review test covering basic topics such as atomic structure, chemical nomenclature and stoichiometry (material which will be reviewed during weeks 1 and 2) will be written during lecture time of week 3. Announcements will be made in class about the material to be covered in the two term tests and the midterm test.

Attendance at the laboratory is mandatory. If you miss more than two experiments without a satisfactory excuse you will automatically fail the course. If you are sick enough to miss the laboratory class you are sick enough to get a doctor's note or equivalent, and this will normally be expected if you are unable to attend the laboratory. It is important to let me know as quickly as possible if you are unable to attend the laboratory or an exam.

If you miss an experiment or exam without a suitable excuse, or if you fail to submit a lab report within seven days of completing the experiment you will normally receive a mark of zero for that component of the course.

You must achieve passing marks in **each of** (i) the lab, (ii) the lecture components (i.e., the set of all tests and exams associated with the lectures) and (iii) the final exam to pass the course.

You are responsible for obtaining safety glasses and a lab coat. It is not the responsibility of the College to provide you with safety equipment.

6. Grading System

(No changes are to be made to this section unless the Approved Course Description has been forwarded through the Education Council of Camosun College for approval.)

Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy E-1.5 at **camosun.ca** for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	*Incomplete*: A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	*In progress*: A temporary grade assigned for courses that, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. *(For these courses a final grade will be assigned to either the 3rd course attempt or at the point of course completion.)*
CW	*Compulsory Withdrawal:* A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning.
This information is available in the College calendar, at Student Services, or the College web site at camosun.ca.

STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**.
It is the student's responsibility to become familiar with the content of this policy.
The policy is available in each School Administration Office, at Student Services,
and the College web site in the Policy Section.

ADDITIONAL COMMENTS AS APPROPRIATE OR AS REQUIRED