CAMOSUN COLLEGE	**School of Arts & Science** **CHEMISTRY AND GEOSCIENCE DEPARTMENT** **CHEM 150 - X01A** **Engineering Chemistry** **Quarter 01/2016**

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:	Tues/Wed/Thurs 1600 – 1630 (provisional)		
(c)	Location:	CC118A		
(d)	Phone:		Alternative Phone:	
(e)	Email:	CartwrightH@camosun.bc.ca		
(f)	Website:	Class material on D2L		

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. Predict properties of polymers, ceramics and other 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 concentrations of participating molecules in chemical equilibria, in particular, aqueous equilibria. Determine the pH of dilute aqueous solutions of acids and bases.
9. Explain the importance of total energy, enthalpy, entropy and free energy in chemical processes.
10. Balance redox equations. Determine the voltages of simple electrochemical cells. Describe the role of electrochemistry in corrosion and corrosion control.
11. Use Molecular Orbital Theory to describe the properties of metals and semiconductors.

3. Required Materials

(a) No textbook is required; some notes will be provided on D2L. Nevertheless, you should ensure that you have access to a first year university chemistry text to supplement the notes and classes. You may use the current edition of any text at the right level, but a slightly older edition borrowed from the library or a friend 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 the course, is available on D2L. Either bring a printed copy to every laboratory session, or ensure you have the means to read it online. Reading the instructions in advance will both save you time and contribute to safe working. **You must bring safety glasses to each lab session**. It is not the responsibility of the College to provide you with safety equipment. 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

The course starts on September 26, 2016.

Lectures:	Tuesday, Wednesday, Thursday	4.30 – 5.20	TEC 173
	Friday	9.30 – 11.20	TEC 175
Laboratory:	Section X01A Tuesday	1.30 – 4.20	TEC 230

Lecture schedule (details and ordering subject to change)

A. Foundations
Matter, elements, compounds and mixtures, metals and non-metals, Dalton's atomic theory, atoms and molecules, fundamental particles and atomic structure, evidence for atoms, atomic weights, isotopes.

B/C. Nomenclature and stoichiometry, Simple Bonding
Reaction 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.

D. Structure and Shape
Molecular shape, Lewis structures of further molecules and ions, resonance hybrids, formal charge, Valence Shell Electron Pair Repulsion Theory, exceptions to the octet rule, odd electron species, electron deficient compounds, expanded valence shells, coordinate covalent bonds.

E. Intermolecular Forces
Electronegativity, polar covalent bonds, link between polarity and molecular shape, resultant dipole moment. Intermolecular forces, dipole-dipole, London dispersion forces, induced dipole-induced dipole, polarizability and molecular shape, hydrogen bonding, boiling point, melting point, surface tension, viscosity, vapour pressure, phase diagrams.

F. Properties of solutions
Colligative properties, Raoult's Law, osmotic pressure.

G. Gases
Units of pressure, Boyle's law, Charles's law, Avogadro's law, ideal gas law, Dalton's law of partial pressure, kinetic molecular theory, effusion, diffusion, real gases, Van der Waals equation, Joule-Thomson effect.

H. Thermochemistry
Work and heat, systems and surroundings, laws of thermodynamics, internal energy, state functions, enthalpy of reaction, heat capacities, Hess's law, enthalpies of formation, entropy, spontaneous processes, irreversible processes, Gibbs free energy.

I. Electrolytes
Dissociation and ionization, pH of strong and weak acids and bases, pH of salt solutions, buffers, molecular structure and acid base behaviour.

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

K. Introductory Quantum Theory
Electromagnetic radiation, photoelectric effect, Planck's equation, wave-particle duality, 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 dia-magnetism.

L. Advanced Bonding Models
Valence-bond method, hybridization sp^3, sp^2 and sp hybrid orbitals. Strengths and limits of VB. 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.

M. What is Organic Chemistry?
Functional groups, polymers.

Important dates:

September 26	(Monday)	Course starts
October 10	(Monday)	Thanksgiving Day – College closed
October 14	(Friday)	Final Exam timetable posted
November 11	(Friday)	Remembrance Day – College closed
December 9	(Friday)	Last day of instruction
December 12	(Monday)	Exam period starts
December 16	(Friday)	Exam period ends

Provisional Laboratory and Examination Schedule:

Week 1 (September 27)	Introduction to Laboratory work
Week 2 (October 4)	Experiment 1: Densities
Week 3 (October 11)	No experiment
	Review test (Tuesday October 11, 1630 - 1720, TEC 175)
Week 4 (October 18)	Experiment 2: Stoichiometry
Week 5 (October 25)	Experiment 3: Spectroscopic determination of nickel.
	Midterm test 1 (Friday October 28, 0930 - 1100, place TBA)
Week 6 (November 1)	Experiment 5: Distillation
Week 7 (November 8)	Experiment 8: Copper recycling
Week 8 (November 15)	Experiment 4: Thermochemistry
	Midterm test 2 (Friday November 18, 0930-1100, place TBA)
Week 9 (November 22)	No experiment
Week 10 (November 29)	Experiment 6: Determination of chloride.
Week 11 (December 6)	Review

5. Basis of Student Assessment (Weighting)

The course mark will be calculated as follows:

Review test	5 %	MidTerm tests (two)	17.5 % each
Problems	5 %	Lab work	20 %
Final exam	35 %		

Problem sets, completion of which will help you both to understand the course and to prepare for the exams, will be provided approximately weekly. Half of the marks for the problem sets will be gained by submitting suitable answers to a minimum of 50% of the problems by the appropriate deadline. The remaining 50% of the marks for problems will be allocated to a group of three problems in each set, which will be graded. Further details will be provided in class.

A 50-minute test covering basic 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 review test and the midterm tests.

Attendance at the laboratory is mandatory unless you have been granted credit for previously achieving a suitable mark in the laboratory course. If you miss more than two experiments without a satisfactory excuse you will automatically fail the course. If you are sick enough to miss an experiment or an exam you are sick enough to get a doctor's note or equivalent. It is important to let the instructor know as quickly as possible if you cannot 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 the deadline (which is generally seven days after completion of the experiment) you will normally receive a mark of zero for that component of the course.

To pass Chem 150 you must achieve passing marks in **each of** (i) the laboratory course, (ii) the lecture components (i.e., a combination of the review exam, the midterm exams and the problems) and (iii) the final exam.

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