CAMOSUN COLLEGE	**School of Arts & Science** **CHEMISTRY AND GEOSCIENCE DEPARTMENT** **CHEM 150** **Engineering Chemistry** **Quarter 4 2013**

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:	Daniel Donnecke		
(b)	Office Hours:	Wednesday 12:30 – 13:20 pm		
(c)	Location:	Tec 230		
(d)	Phone:	250 370 4447	Alternative Phone:	
(e)	Email:	donnecked@camosun.bc.ca		
(f)	Website:			

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 rate constants, 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 reactions. 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 text is required, but it is 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) You need safety glasses, the lab manual (on d2l) and a lab coat for the laboratory

4. Course Content and Schedule

Timetable

Lectures:	Sections X01A/B: Mo, Tu, Wed, Th, Fr from 10:30 till 11:20 Sections X02A/B: Mo, Tu, Wed, Th, Fr from 11:30 till 12:30
Laboratory:	Sections X01A **Thursday** 14:30 - 17:20, Tech 230 Sections X01B **Friday** 14:30 - 17:20, Tech 230
	Sections X02A **Wednesday** 14:30 - 17:20, Tech 230 Sections X02B **Tuesday** 14:30 - 17:20, Tech 230

Detailed outline (schedule subject to availability of equipment)

Week	Activity
1	Lab safety **EVERYONE ATTENDS**
2	1 July, Canada Day, College closed *Lab 1* Densities
3	*Lab 2* Stoichiometry **Review test** (50 min, during lecture time)
4	*Lab 3* Spectroscopic Determination of Nickel
5	*Lab 5* Distillation **Term Test 1** (50 min, during lecture time)
6	*Lab 4* Thermochemistry
7	5 August, BC Day, College closed *No Labs during midterm week!* **(Midterm**, 90 min, time and place to be determined)
8	*Lab TBA*
9	*Lab 7* Bromination of Acetone
10	*Lab 6* Determination of Chloride **Term Test 2** (50 min, during lecture time)
11	2 September, Labour Day, College closed Review of the course material and demos during lab sections
	Week 12: Final Examination Period

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, 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, 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 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.

5. Basis of Student Assessment (Weighting)

(This section should be directly linked to the Intended Learning Outcomes.)

Evaluation	**Grading as in Camosun College Calendar**		
Review test	**7 %**	**Term Tests (two)**	**10 % each**
Midterm	**18 %**	**Lab**	**20 %**
Final	**35 %**		

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