



CHEM 160 Chemistry and Materials, Quarter 2: January to March, 2010

General Information

Instructor: Daniel Dönnecke

Office: Tec 232

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Office Hours: Wednesday and Thursday 11:30 - 12:20 in Tec 232

Text:

No text is required, but it is highly recommended that you have a first year university chemistry text, either used or from the library.

Lab Manual online (D2L)

You need to print this manual out and bring it to each lab. It contains the procedures for the experiments and instructions on the labwrite-up.

Timetable

Lectures: Monday, Tuesday, Wednesday and Thursday 12:30 – 13:20 (section X01) and 13:30 – 14:20 (section X02) in **Tec 173**

Laboratory: Friday at 11:30 - 13:20 (section X01A and X01B alternate weeks) and 13:30 - 15:20 (section X02A and X02B alternate weeks) in **Tec 230**.

Intended learning outcomes:

- Use the Lewis model of the atom in conjunction with the periodic table to predict the chemical and physical properties of elements, including chemical bonding and the formation of compounds.
- Write balanced chemical equations for chemical reactions including reduction-oxidation reactions, and determine stoichiometric quantities of reactants in those reactions.
- Determine properties of pure chemicals and of mixtures of chemicals based on solid, liquid and gaseous phases, and interpret solid and liquid phase diagrams for engineering materials.
- Apply the principles of thermodynamics to determine rates of chemical reaction, chemical equilibrium, and energy changes in chemical transformations.
- Apply the principles of electrochemistry to determine corrosion potential and inhibition, and electrolytic processes.
- Apply the principles of organic chemistry to the structure and naming of organic compounds, in particular polymers, and identify properties associated with specific functional groups.

Evaluation

Grading as in Camosun College Calendar

Laboratory (4)	12%
Term Tests(3)	18%
Midterm	20%
Final	50%
Total	100%

Term Tests will cover sections of the course while the midterm and the final will cover all the material up to the midterm and the final respectively. Problem sets which will help you prepare for exams will be posted on D2L approximately biweekly. These problem sets will not be graded but answer keys will be published. A lab that is missed without a valid reason such as a doctor's note or incomplete because no report was handed in by the beginning of the following lab period receives a mark of zero. If you miss a term test or the midterm because you were ill or had a serious emergency of which you have informed me before or immediately after the exam and provided acceptable proof you will be granted a rewrite at a time convenient to both of us.

Detailed outline

Week	Activity
1	Matter, atoms, molecules, chemical reactions, mole, stoichiometry Periodic Table, Ionic and covalent bonding Lab safety
2	Polar bonds, molecular shape, polar molecules Lewis structures <i>Lab 1</i> Stoichiometry
3	Term Test 1; Gases, liquids, solids Mixtures, solutions <i>Lab 1</i> Stoichiometry
4	States of matter, Phase changes <i>Lab 2</i> Distillation
5	Midterm Thermochemistry, thermodynamics, ΔH , ΔS , ΔG <i>Lab 2</i> Distillation
6	Equilibrium Aqueous equilibrium, pH <i>Lab 3</i> Heat of combustion
7	Oxidation/reduction, Electrochemistry Corrosion Reading Break College closed
8	Term Test 2; Organic chemistry, nomenclature <i>Lab 3</i> Heat of combustion
9	Organic chemistry, functional groups Organic chemistry, functional groups, reactions <i>Lab 4</i> Aspirin
10	Term Test 3; Organic reactions; polymers Polymers <i>Lab 4</i> Aspirin
11	Polymers Composites, ceramics Review
March 22-26: Final Examination Period	

Detailed Lecture Outline

Week	Activity
1	<p>Matter, atoms, molecules, basic chemical reactions, review mole concept, stoichiometry, limiting reactant and % yield.</p> <p>Mendeleev's Periodic Table, cathode rays, Rutherford and Moseley's contributions, metals, non-metals and metalloids, chemical families, ionic and metallic bonding.</p> <p>Trends in ionization energy, atomic and ionic radii and electron affinity.</p> <p>Valence electrons, shell structure of the atom, Bohr's model. Octet rule. Sharing of electrons. Covalent bonding. Lewis structure of simple diatomic molecules.</p>
2	<p>Electronegativity, polar bonds, dipole moments, partial charges.</p> <p>Lewis structures of polyatomic molecules and ions, resonance structures and formal charges, equivalent and non-equivalent resonance structures, the "best" Lewis structure, resonance hybrids, shape of molecules, VSEPR, resultant dipole moments, polar molecules,</p>
3	<p>Term Test 1; Gases, liquids, solids Mixtures, solutions</p> <p>Van der Waals forces including dipole - dipole interactions, ion-dipole interaction (solvation of ions) and London dispersion forces. Instantaneous dipole, induced dipole, polarizability, melting and boiling points of molecular species, energy changes associated with states of matter, viscosity, surface tension, vapour pressure, colligative properties, Henry's and Raoult's law.</p>
4	<p>Ideal gases, gas laws, reactions involving gases, diffusion, effusion, kinetic molecular gas theory, molar volume, real gases, Van der Waals equation, Joule Thomson effect, Linde process</p> <p>Phase changes, phase diagrams, vaporization, boiling, condensing, melting solidifying, subliming, artificial diamonds, supercritical fluids.</p>

Midterm

- Thermochemistry, define system (closed, open, isolated) and surroundings. Total energy and free energy of a system. Spontaneous and non-spontaneous processes, entropy,
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- Aqueous chemistry and equilibrium, dissociation and ionizing, pH of strong acids and strong bases, pH of weak acids and weak bases, pH of salts, an introduction to buffers
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- Oxidation/reduction, Electrochemistry, Voltaic cells, standard hydrogen electrode, electrochemical series, cell potential at standard and non-standard state, Nernst equation, Corrosion and corrosion protection, batteries and fuel cells
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Term Test 2;

- 8 Organic chemistry, nomenclature

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- Organic chemistry, functional groups (olefins, alcohols, carboxylic acids, amines)
- 9 Organic chemistry, functional groups, reactions (esters, amids, polymerization)

Term Test 3;

- 10 Polymers: polyethylene, polyvinylchloride, rubber, neoprene, Teflon, polyester, nylon,

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- Inorganic polymers,: Silicones, silicates, carbon nano-tubes,
- 11 Ceramics and composites,
- Review

March 23-27: Exam week