Grande Prairie Regional College
Department: Academic Upgrading

COURSE OUTLINE - Fall 2009
CH0130 - Chemistry Grade 12 Equivalent

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Calendar Description: CH 0130 - Chemistry Grade 12 Equivalent 5 (5-0-1.5) HS

Concepts in this course include: thermochemical changes; reaction kinetics and equilibrium; acids and bases; electrochemical changes; and important chemical changes of select classes of organic compounds. Energy changes and safety are emphasized throughout the course.

Prerequisite: CH0120 or equivalent, and MA0110 or equivalent.
Credit/Contact Hours: 5 credits; 6.5 contact hours per week

Required Text and Resource Materials:

- Nelson Chemistry (Alberta 20 -30)
- Chemistry Data Booklet (revised 2008)
- Scientific calculator
- 3-ring binder
- Lab Coat
- Lab book (coil or bound)
- graph paper

Attendance: Regular attendance is expected of all students and is crucial to good performance in the course. Class interruption due to lateness will not be permitted. You may be debarred from the final exam if your absences exceed 15% (10 days) of class days.

Tests and Exams: All tests and exams **MUST** be written at the scheduled times unless **PRIOR** arrangements have been made with the instructor. A missed test(exam) will result in a score of **ZERO** on that test (exam).

Labs: Attendance is compulsory in all labs. A missed lab will result in a score of ZERO in that lab. Make-up labs CANNOT be guaranteed. Labs reports must be handed in by the deadlines announced. Late lab reports will result in a penalty of 10% per day. Labs handed in after two days will not be graded without PRIOR approval.

Evaluation: Course final grade will be based on the following components.

4 Unit Tests	35%
Labs	15%
Midterm Exam	20%
Final Exam	30%

The final exam is 3 hours long and is scheduled by the registrars' office during Exam weeks.
Final Grades will be assigned on the Letter Grading System.

Chemistry 0130 consists of four units

(approx. 3 weeks each including two labs & one exam)

A. Thermochemical Changes (ch 11,12)
B. Electrochemical Changes (ch 13,14)
C. Chemical Equilibrium Focusing on Acid-Base Systems (ch 15,16)
D. Chemical Changes of Organic Compounds (ch 9,10)

Course Evaluation
Academic Upgrading Department
Grading Conversion Chart

Alpha Grade	4-point Equivalent	Percentage Guidelines	Designation
A+	4	90 - 100	EXCELLENT
A	4	85 - 89	
A-	3.7	80 - 84	FIRST CLASS STANDING
B+	3.3	76 - 79	
B	3	73 - 75	GOOD
B-	2.7	70 - 72	
C+	2.3	67 - 69	SATISFACTORY
C	2	64 - 66	
C-	1.7	60 - 63	
D+	1.3	55 - 59	MINIMAL PASS
D	1	50 - 54	
F	0	0 - 49	FAIL

AUD STUDENT CLASSROOM DEPORTMENT GUIDELINES

The Academic Upgrading Department is an adult education environment. Students are expected to show respect for each other as well as faculty and staff. They are expected to participate fully in achieving their educational goals.

Certain activities are disruptive and not conducive to an atmosphere of learning. In addition to the ***Student Rights and Responsibilities*** as set out in the College calendar, the following guidelines will maintain an effective learning environment for everyone. We ask the cooperation of all students in the following areas of classroom deportment.

1. Students are expected to <u>turn off cell phones</u> during class time or in labs.
   No unspecified electronic devices will be allowed in exams.
2. Refrain from disruptive talking or socializing during class time.
3. Be respectful of others regarding food or beverages in the classroom.
   Clean up your eating area and dispose of garbage.
4. Recycle paper, bottles and cans in the appropriate containers.
5. Students are expected to arrive on time and to remain for the duration of scheduled classe.
6. Children are not permitted in the classrooms.
7. Students are expected to notify his/her instructor of any extenuating circumstances.

<u>Plagiarism:</u> The instructor reserves the right to use electronic plagiarism detection services.

CH0310 Detailed Course Outline

Unit A. Thermochemical Changes — Key Concepts:

- enthalpy of formation
- enthalpy of reaction
- ΔH notation
- Hess' law
- molar enthalpy
- energy diagrams
- activation energy
- catalysts
- calorimetry
- fuels and energy efficiency

General Outcomes

1. determine and interpret energy changes in chemical reactions
   - recall the application of $Q = mc\Delta t$ to the analysis of heat transfer
   - explain, in a general way, how stored energy in the chemical bonds of hydrocarbons originated from the sun
   - define enthalpy and molar enthalpy for chemical reactions
   - write balanced equations for chemical reactions that include energy changes
   - use and interpret ΔH notation to communicate and calculate energy changes in chemical reactions
   - predict the enthalpy change for chemical equations using standard enthalpies of formation
   - explain and use Hess' law to calculate energy changes for a net reaction from a series of reactions
   - use calorimetry data to determine the enthalpy changes in chemical reactions
   - identify that liquid water and carbon dioxide gas are reactants in photosynthesis and products of cellular respiration and that gaseous water and carbon dioxide gas are the products of hydrocarbon combustion in an open system
   - classify chemical reactions as endothermic or exothermic, including those for the processes of photosynthesis, cellular respiration and hydrocarbon combustion

2. explain and communicate energy changes in chemical reactions.
   - define activation energy as the energy barrier that must be overcome for a chemical reaction to occur
   - explain the energy changes that occur during chemical reactions, referring to bonds
   - breaking and forming and changes in potential and kinetic energy
   - analyze and label energy diagrams of a chemical reaction, including reactants, products, enthalpy change and activation energy
   - explain that catalysts increase reaction rates by providing alternate pathways for changes, without affecting the net amount of energy involved; *e.g., enzymes in living systems*.

Unit B. Electrochemical Changes

Key Concepts:

- reduction
- oxidation
- oxidizing agent
- reducing agent
- oxidation-reduction (redox) reaction
- oxidation number
- half-reaction
- disproportionation
- spontaneity
- standard reduction potential
- voltaic cell
- electrolytic cell
- electrolysis
- standard cell potential
- Faraday's law
- corrosion

General Outcomes

1. explain the nature of oxidation-reduction reactions
   - define oxidation and reduction operationally and theoretically
   - define oxidizing agent, reducing agent, oxidation number, half-reaction, disproportionation
   - differentiate between redox reactions and other reactions, using half-reactions and/or oxidation numbers
   - identify electron transfer, oxidizing agents and reducing agents in redox reactions that occur in everyday life, in both living systems (*e.g., cellular respiration, photosynthesis*) and nonliving systems; i.e., corrosion
   - compare the relative strengths of oxidizing and reducing agents, using empirical data
   - predict the spontaneity of a redox reaction, based on standard reduction potentials, and compare their predictions to experimental results
   - write and balance equations for redox reactions in acidic and neutral solutions by
     -using half-reaction equations obtained from a standard reduction potential table
     -developing simple half-reaction equations from information provided about redox changes
     -assigning oxidation numbers, where appropriate, to the species undergoing chemical change
   - perform calculations to determine quantities of substances involved in redox titrations

2. apply the principles of oxidation-reduction to electrochemical cells.

   - define anode, cathode, anion, cation, salt bridge/porous cup, electrolyte, external circuit, power supply, voltaic cell and electrolytic cell
   - identify the similarities and differences between the operation of a voltaic cell and that of
   - an electrolytic cell
   - predict and write the half-reaction equation that occurs at each electrode in an electrochemical cell
   - recognize that predicted reactions do not always occur; *e.g., the production of chlorine gas*
   - *from the electrolysis of brine*
   - explain that the values of standard reduction potential are all relative to 0 volts, as set for the hydrogen electrode at standard conditions
   - calculate the standard cell potential for electrochemical cells
   - predict the spontaneity or nonspontaneity of redox reactions, based on standard cell potential, and the relative positions of half-reaction equations on a standard reduction potential table
   - calculate mass, amounts, current and time in single voltaic and electrolytic cells by applying Faraday's law and stoichiometry.

Unit C. Chemical Equilibrium Focusing on Acid-Base Systems

Key Concepts:

- chemical equilibrium systems
- Brønsted–Lowry acids and bases
- reversibility of reactions
- Le Chatelier's principle
- titration curves
- conjugate pairs of acids and bases
- equilibrium law expression
- amphiprotic substances
- equilibrium constants K_c , K_w , K_a , K_b
- buffers
- acid-base equilibrium
- indicators

General Outcomes

1. explain that there is a balance of opposing reactions in chemical equilibrium systems
   - define equilibrium and state the criteria that apply to a chemical system in equilibrium; i.e., closed system, constancy of properties, equal rates of forward and reverse reactions
   - identify, write and interpret chemical equations for systems at equilibrium
   - predict, qualitatively, using Le Chatelier's principle, shifts in equilibrium caused by changes in temperature, pressure, volume, concentration or the addition of a catalyst and describe how these changes affect the equilibrium constant
   - define Kc to predict the extent of the reaction and write equilibrium-law expressions for given chemical equations, using lowest whole-number coefficients
   - describe Brønsted–Lowry acids as proton donors and bases as proton acceptors
   - write Brønsted–Lowry equations, including indicators, and predict whether reactants or products are favoured for acid-base equilibrium reactions for monoprotic and polyprotic acids and bases
   - identify conjugate pairs and amphiprotic substances
   - define a buffer as relatively large amounts of a weak acid or base and its conjugate in equilibrium that maintain a relatively constant pH when small amounts of acid or base are added.

2. determine quantitative relationships in simple equilibrium systems.
   - recall the concepts of pH and hydronium ion concentration and pOH and hydroxide ion concentration, in relation to acids and bases
   - define K_w , K_a , K_b and use these to determine pH, pOH, $[H_3O^+]$ and $[OH^-]$ of acidic and basic solutions
   - calculate equilibrium constants and concentrations for homogeneous systems and Brønsted–Lowry acids and bases (excluding buffers) when
     - concentrations at equilibrium are known
     - initial concentrations and one equilibrium concentration are known
     - the equilibrium constant and one equilibrium concentration are known.

Unit D: **Chemical Changes of Organic Compounds**

Key Concepts:
- organic compounds
- naming organic compounds
- structural formulas
- structural isomers
- monomers
- polymers

General Outcomes

1. explore organic compounds as a common form of matter
   - define organic compounds as compounds containing carbon, recognizing inorganic exceptions such as carbonates, cyanides, carbides and oxides of carbon
   - dentify and describe significant organic compounds in daily life, demonstrating generalized knowledge of their origins and applications; *e.g., methane, methanol, ethane, ethanol, ethanoic acid, propane, benzene, octane, glucose, polyethylene*
   - name and draw structural, condensed structural and line diagrams and formulas, using International Union of Pure and Applied Chemistry (IUPAC) nomenclature guidelines, for saturated and unsaturated aliphatic (including cyclic) and aromatic carbon compounds
     - containing up to 10 carbon atoms in the parent chain (*e.g., pentane; 3-ethyl-2,4-dimethylpentane*) or cyclic structure (*e.g., cyclopentane*)
     - containing only one type of a functional group (with multiple bonds categorized as a functional group; *e.g., pent-2-ene*), including simple halogenated hydrocarbons (*e.g., 2-chloropentane*), alcohols (*e.g., pentan-2-ol*), carboxylic acids (*e.g., pentanoic acid*) and esters (*e.g., methyl pentanoate*), and with multiple occurrences of the functional group limited to halogens (*e.g., 2-bromo-1-chloropentane*) and alcohols (*e.g., pentane-2,3-diol*)
   - identify types of compounds from the hydroxyl, carboxyl, ester linkage and halogen functional groups, given the structural formula
   - define structural isomerism as compounds having the same empirical formulas, but with different structural formulas, and relate the structures to variations in the properties of the isomers
   - compare, both within a homologous series and among compounds with different functional groups, the boiling points and solubility of examples of aliphatics, aromatics, alcohols and carboxylic acids
   - describe, in general terms, the physical, chemical and technological processes (fractional distillation and solvent extraction) used to separate organic compounds from natural mixtures or solutions; *e.g., petroleum refining, bitumen recovery.*

2. describe chemical reactions of organic compounds.
   - esterification and combustion reactions
   - predict products and write and interpret balanced equations for the above reactions
   - define, illustrate and provide examples of monomers *(e.g., ethylene)*, polymers *(e.g., polyethylene)* and polymerization in living systems *(e.g., carbohydrates, proteins)* and nonliving systems *(e.g., nylon, polyester, plastics)*
   - relate the reactions described above to major reactions that produce thermal energy and economically important compounds from fossil fuels.