DEPARTMENT OF ACADEMIC UPGRADING
COURSE OUTLINE Fall 2020

CH 0130 (A2) - Chemistry Grade 12 Equivalent 5 (5-0-2.0) HS
7 hours/week for 15 weeks (105 hours)

INSTRUCTOR: Tanya Keller **PHONE:** Office: 780–539–2980
OFFICE: J216 **E-MAIL:** tkeller@gprc.ab.ca

OFFICE HOURS: by appointment via Zoom

CALENDAR DESCRIPTION: CH 0130 - Chemistry Grade 12 Equivalent 5 (5-0-2.0) HS Course concepts include thermochemical changes; electrochemical changes; chemical equilibrium focusing on acid-base systems; and chemical reactions of select classes of organic compounds. Energy changes and safety are emphasized.

PREREQUISITE(S)/COREQUISITE: CH0120 (Chemistry 20), and MA0122 (Math 20-2), or MA0120 (Math 20-1) or MA0130 placement.

REQUIRED TEXT/RESOURCE MATERIALS:
Nelson Chemistry (Alberta 20-30)
Chemistry Data Booklet (can be printed from myClass)
Scientific non-programmable calculator (if you need to purchase, TI-30XIIS is recommended)
Lab Coat
Lab Safety Glasses
graph paper (fine lined *10 lines/cm* - may be printed from myClass)
Note: There are approximately 300 pages of recommended printing for this course.
It is strongly recommended that you have access to a printer and scanner or that you download the TapScanner or CamScanner apps (both have a free version) for your smartphone. All assignments and the written component of the Unit Exams will need to be scanned in order to submit them for grading.

FALL 2020 DELIVERY: Mixed Delivery. This course is delivered remotely with some face to-face/onsite components at the GPRC Grande Prairie campus.

- For the remote delivery components: students must have a computer with a webcam and reliable internet connection. MyClass will be used extensively. Technological support is available through helpdesk@gprc.ab.ca.
- For the onsite components: students must supply their own mask and follow GPRC Campus Access Guidelines and Expectations. The dates and locations of the onsite components can be found on the Course Calendar.

COURSE OBJECTIVES: ***Students will:***

Thermochemical Changes
- determine and interpret energy changes in chemical reactions
- explain and communicate energy changes in chemical reactions.

Electrochemical Changes
- explain the nature of oxidation-reduction reactions
- apply the principles of oxidation-reduction to electrochemical cells.

Chemical Equilibrium Focusing on Acid-Base Systems
- explain that there is a balance of opposing reactions in chemical equilibrium systems
- determine quantitative relationships in simple equilibrium systems.

Chemical Changes of Organic Compounds
- explore organic compounds as a common form of matter
- describe chemical reactions of organic compounds.

Lab Skill objectives (focus on scientific inquiry)

- Initiate and Plan
- Perform and Record
- Analyze and Interpret
- Communicate and work in a Team

LEARNING OUTCOMES: Please see detailed Course outline which follows (pages 4-7).

TRANSFERABILITY:
Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability. This course is listed in the Alberta Transfer Guide as equivalent to Math 30-1.
**Although 50% (D) is considered a pass for this course, it is strongly recommend that you achieve a mark of 65% (C) to be successful at the next level.

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

Unit Tests (equally weighted)	50%	
Labs	10%	**Late penalty 20% per day for 2 days.**
Assignments, Quizzes	10%	**Late penalty 20% per day for 2 days.**
Final Exam (Cumulative)	30%	

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). Only in very specific cases may student be given an opportunity to make up a missed exam (student will be presented with a different version of the exam). Doctor, lawyer or police documentation may be required. The final exam is 3 hours long and is scheduled by the registrars' office during GPRC Exam weeks. Do not book vacation in this time period.

GRADING CRITERIA: Final Grades will be assigned on the Letter Grading System.

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	90-100	C+	2.3	67-69
A	4.0	85-89	C	2.0	63-66
A-	3.7	80-84	C-	1.7	60-62
B+	3.3	77-79	D+	1.3	55-59
B	3.0	73-76	D	1.0	50-54
B-	2.7	70-72	F	0.0	00-49

- Attendance is strongly recommended in all labs.
- Missed labs result in a score of zero. **There are NO make-up labs.**
- In particular, you must attend the Lab Safety and Orientation. If you miss it, you will be excluded from participating in the lab component of the course.
- If you are late and have missed the lab safety discussion, you may be excluded from participating in the lab and will receive a mark of zero.
- **Lab reports are due on the Friday following the lab**. Late lab reports will result in a penalty of 20% per day. Labs over two days late will not be graded without PRIOR approval.
- Download the lab sheets and complete the Pre-lab assignment before the lab period, data tables are completed during the lab and analysis and questions after the lab.

Lab Schedule will be provided as part of your course timeline, posted on myClass.

STUDENT RESPONSIBILITIES:

Refer to the College Policy on Student Rights and Responsibilities at
https://www.gprc.ab.ca/files/forms_documents/StudentRightsandResponsibilities.pdf

The Academic Upgrading Department is an adult education environment. Students are expected to show respect for each other as well as faculty and staff. Students 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. **Attendance**: Regular attendance and class participation is expected of all students and is crucial to good performance in the course. Class interruption due to habitual late arrival or leaving early will not be permitted. You may be debarred from the final exam if your absences exceed 15% of class days (10 lecture classes).
2. Check **myClass** as well as **GPRC email** on a regular basis. Any changes to the Course Timeline or Exam Dates will be communicated on myClass. Students will be held to the deadlines listed on the Course Timeline whether or not those deadlines are spoken about in class.
3. **Once in class** – remain in class. Leaving to get a coffee is disruptive for others.
4. Assignments must be submitted on time.
5. Exams must be written on the days announced in class.
6. If an emergency prevents attendance on an exam day, students must contact me before the end of the exam (as soon as possible) via phone or email, and may be asked to provide documentation to justify their absence.
7. No unspecified electronic devices will be permitted during exams.
8. Complete daily homework. **At least 1.5** hours of study per day outside of class time is required.
9. Behaviors that interfere with learning are not acceptable.
10. Take responsibility for your learning.
11. **Communicate all requests regarding appointments, etc via email**.

STATEMENT ON PLAGIARISM AND CHEATING:

Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Calendar at http://www.gprc.ab.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at https://www.gprc.ab.ca/about/administration/policies

**Note: all Academic and Administrative policies are available on the same page.

CH0310 Detailed Course Outline and Learning Objectives (adapted from Alberta Learning Chemistry 30 curriculum http://education.alberta.ca/media/654849/chem2030_07.pdf)

Unit A. Thermochemical Changes

Key Concepts:

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

General Outcomes

Students will:

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
- 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:

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

General Outcomes

Students will:

- 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

1. 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 non-spontaneity 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
- reversibility of reactions
- titration curves
- equilibrium law expression
- equilibrium constants Kc , Kw , Ka , Kb
- acid-base equilibrium
- Brønsted–Lowry acids and bases
- Le Chatelier's principle
- conjugate pairs of acids and bases
- amphiprotic substances
- buffers
- indicators

General Outcomes

Students will:

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 K_c 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 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 (ICE table)
  - 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
- esterification
- combustion reactions
- polymerization
- addition, substitution
- elimination
- aliphatic and aromatic compounds
- saturated/unsaturated hydrocarbons
- functional groups identifying alcohols, carboxylic acids, esters and halogenated hydrocarbons

General Outcomes

Students will:

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
- identify 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 (general trends only)

2. describe chemical reactions of organic compounds.

- define and identify simple addition, elimination, substitution, 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) (addition and condensation polymers)
- relate the reactions described above to major reactions that produce thermal energy and economically important compounds from fossil fuels.

Lab Skills and objectives are included in labs and assignments in each unit of the course.

Specific Outcomes for Skills (focus on scientific inquiry)

Initiating and Planning

Students will:

- identify, define and delimit questions to investigate
- design an experiment, identifying and controlling major variables
- state a prediction and a hypothesis based on available evidence or background information or on a theory
- evaluate and select appropriate procedures, including appropriate sampling procedures, and instruments for collecting evidence and information

Performing and Recording

Students will:

- research, integrate and synthesize information from various print and electronic sources regarding a scientific question
- select and use appropriate instruments for collecting data effectively, safely and accurately
- carry out procedures, controlling the major variables, and adapt or extend procedures where required
- compile and organize findings and data by hand or computer, using appropriate formats such as diagrams, flowcharts, tables and graphs
- apply Workplace Hazardous Materials Information System (WHMIS) standards to handle and dispose of materials

Analyzing and Interpreting

Students will:

- apply appropriate terminology, classification systems and nomenclature used in the sciences
- interpret patterns and trends in data and predict the value of a variable by interpolating or extrapolating from graphical data or from a line of best fit
- estimate and calculate the value of variables, compare theoretical and empirical values, and account for discrepancies
- identify limitations of data or measurements; explain sources of error; and evaluate the relevance, reliability and adequacy of data and data collection methods
- identify new questions or problems that arise from what was learned
- state a conclusion, based on data obtained from investigations, and explain how evidence gathered supports or refutes a hypothesis, prediction or theory

Communication and Teamwork

Students will:

- work collaboratively to develop and carry out investigations
- select and use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate findings and conclusions
- evaluate individual and group processes used in planning and carrying out investigative task