DEPARTMENT OF ACADEMIC UPGRADING

COURSE OUTLINE FALL 2017

CH 0130 (A2,B2): CHEMISTRY GRADE 12 EQUIVALENT –

5(5 – 0 – 1.5) 95 HOURS FOR 15 WEEKS

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Office Hours	AS POSTED ON MY OFFICE DOOR.		

CALENDAR

DESCRIPTION: 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.

PREQUISITES/COREQUISITE(S): CH0120 (Chemistry 20); MA0122 (Math 20-2), or MA0120 (Math 20-1) or MA0130 placement. Also see Academic Upgrading Admission requirements.

REQUIRED TEXT/RESOURCE MATERIAL:

***** General Chemistry by Ebbing 11th Edition or 10th**

*** **Chemistry 0110 Review** if you were not in SC 0110 last semester.

- **CH 0130 lab manual**
- Lab coat
- Lab notebook (250 page coiled notebook is fine do not spend the money on a real lab notebook)
- ***** Non-**programmable calculator – this is the only electronic device allowed during tests and exams.
- 10 quad to 1 cm graph paper are also required.

SUPPLEMENTARY TEXTS: *These textbooks are available on reserve in the library*

Chemistry 0110 Review by Fraser

Chemistry: A Study of Matter by Dorin

Introductory Chemistry: Zumdahl

Basic Chemistry by Seese and Daub 7th Edition

Chemistry: A Basic Introduction by Miller 4th Edition

DELIVERY MODE(S): Lecture will be the main method of delivery. There is also a large laboratory component in this course.

COURSE OBJECTIVES:

Thermochemical Changes:

The following are the topics that I will be covering in this course are:

1. the first law of thermodynamics, as well as distinguishing between system, and the surroundings.
2. enthalpy, endothermic, and exothermic reactions.
3. specific heat and bomb calorimetry, the equation $q = sm\Delta t$ or $mC\Delta T$, heats of formation, reaction, combustion, and neutralization and solving related problems.
4. Hess' law, the solution related problems.
5. transition state theory, activated complex, activation energy, and reaction coordinate.
6. potential energy diagrams for exothermic and endothermic reactions.
7. factors affecting rated of reaction – temperature, concentration, catalyst, collision theory.

Chemical Equilibrium:

The following are the topics that I will be covering in this course are:

1. irreversible and reversible reactions.
2. equilibrium, and conditions affecting equilibrium
3. equilibrium constant and factors that affect it and solution related problems.
4. Le Chatelier's principle, and apply it to predict changes to systems at equilibrium. (K_c).

Acids and Bases:

The following are the topics that I will be covering in this course are:

1. Arrehenius acids and bases.
2. Bronstad – Lowery concept of acids and bases, conjugate acid-base pairs in acid-base reactions.
3. neutralization reactions.
4. strong acids, and bases.
5. strength of acids and bases.
6. Lewis acids and bases.
7. definition of K_w, pH, pOH and solution related problems.
8. expressions for the ionization constants, K_a and K_b, for acids and bases.
9. acid-base indicators.
10. buffers and relationship to living systems.

Thermochemical Changes:

The following are the topics that I will be covering in this course are:

1. oxidation, reduction, oxidizing agent, and reducing agent.
2. the determination of oxidation numbers.
3. writing oxidation and reduction skeletal half reactions, balance the reaction using half reactions.
4. balance the reactions using half reactions in an acidic or basic solution.
5. spontaneous and non-spontaneous reactions.

6. the construction of an electrochemical (also Voltaic or Galvanic) cell using a spontaneous redox reaction
7. the parts of an electrochemical cell and identify the two electrodes – the anode and the cathode
8. definition of reduction potential, E and standard reduction potential, E_0
9. calculation of the standard potential difference, E_0 for a cell when the standard reduction potentials of the two half-reactions making up the cell are known.
10. how to design a cell which uses a given redox reaction (or two half-reactions). Write the complete cell reaction, and calculate E_0 for the cell. Draw diagram for the cell listing all the parts and showing the direction of movement of all the charges.
11. the construction and electrode reactions of common batteries.
12. definition and explanation of electrolysis and electrolytic cell, electrode reactions for the electrolysis of select molten and aqueous solutions. Discuss electroplating.
13. Faraday's laws of electrolysis, and discuss quantitative aspects of electrolysis relating charge, Q, (amount of electricity) to the current and the time.
14. solution of problems based on electrolysis.
15. corrosion, and describe methods to prevent corrosion. (as time permits)
16. how the process of trial and error was used by early people to extract metals from ores (as time permits).

Organic Chemistry:

The following are the topics that I will be covering in this course are:

1. definition of organic chemistry.
2. several functional groups such as: saturated and unsaturated aliphatic, aromatic hydrocarbon compounds, alcohols, aldehydes, ketones, carboxylic acids and esters.
3. names for common organic compounds using IUPAC system. Give formulas of common organic compounds and draw their structural, condensed structural, and line diagrams.
4. definition of isomers.
5. names for saturated and unsaturated aliphatic (including cyclic) and aromatic compounds containing up to ten carbon atoms in the parent chain.
6. carbohydrates, polymer, and monomers.
7. polymerization and hydrolysis.
8. lipids proteins, biochemical reactions and enzymes, nucleic acids

LEARNING OUTCOMES:

Assumed Background Knowledge: (These topics will **NOT** be reviewed in class)

Students should already:

1. be able to perform linear, quadratic, cubic, liquid-dry metric conversions.
2. know elementary atomic structure – what protons, electrons, and neutrons are and where they are in an atom.
3. be able to define atomic number, atomic mass number and how to use them to calculate the number of protons, neutrons, and electrons in an atom.
4. be able to classify of matter.
5. be able to distinguish between chemical and physical properties and changes.
6. be able to draw atomic structure diagram for the first 20 elements.
7. be able to define valence electrons and draw electron dot diagrams.

   If you are unfamiliar with these topics see me. The Chemistry 0110 Review will explain these in detail. It is available in the bookstore. There is an answer key in A-205 and in the reference section of the library.

   In addition to the above material: These topics will be briefly reviewed in class.
8. know nomenclature (naming compounds and writing formulae). ***Nomenclature is one of the most important topics that you will learn at the secondary level. It will NOT be reviewed at the post secondary level. If you are having trouble with this topic, get help IMMEDIATELY!!! See me!***
9. be able to balance equations by inspection.
10. be able to solve stoichiometry problems from chemical equations including mass to moles, mass to mass, mass to volume, and visa versa. Students should also be able to determine the limiting reagent. Most importantly, students should be able to calculate molarity.

Thermochemical Changes:

Students should be able to:

1. define and explain the terms: System, and the Surroundings
2. state and explain the first law of thermodynamics giving examples.
3. explain enthalpy, changes in enthalpy, exothermic and endothermic reactions.

4. write chemical equations to include enthalpy changes
5. define specific heat capacity, s or C, of a substance, and state its units
5. explain the principles and the working of bomb calorimeter, and how it can be used to determine ΔH. Use the equation: q = smΔT or mCΔT to solve related problems
6. define and explain the terms: Enthalpy (H) , and change in enthalpy ΔH) heat (enthalpy) of reaction, ΔH; Heat (enthalpy) of formation, ΔH_f . Standard conditions.
7. calculate the heat (enthalpy H), of a reaction if heats (enthalpies) of formation of all the reactants and the products are given.
8. calculate the heat (enthalpy) of formation of a reactant or a product if the heat (enthalpy) of the reaction, and the heats (enthalpies) of formation of all other species are given
9. state and explain the following terms clearly: Heat of reaction, Heat of combustion, and Heat of neutralization.
10 to state the relationship between heat of formation and the heat of reaction.
11 to solve related problems.
12 to define heat (enthalpy) of combustion, ΔH_C, of a hydrocarbon, and explain how it can be determined using bomb calorimeter. Solve related problems.
13. to state Hess' law, and demonstrate how the enthalpy of a reaction can be calculated if enthalpies of related reactions are given.
14. to solve related problems.
15. to explain in detail transition state theory, activated complex, activation energy, and reaction coordinate. To be able to draw and label diagrams for exothermic and endothermic reactions.
16. collision theory
17. to define a catalyst.
18. to explain the effect of temperature and a catalyst in the rate of reaction.

Chemical Equilibrium:

Students should be able to:

1 define reversible and irrreversible reactions.
2. define equilibrium, and state conditions of equilibrium.
3. define equilibrium constant, and write mathematical expression for equilibrium constant for a given reaction.

4. explain the significance of the equilibrium constant and discuss the factors that affect it
5. solve related mathematical problems.
6. state Le Chatelier's principle, and apply it to predict changes to systems at equilibrium. (K_c).

Acids and Bases:

Students should be able to:

1. define and explain Arrehenius acids and bases
2. define and explain Bronstad – Lowery concept of acids and bases
3. identify acids and bases in an acid-base reaction
4. define and identify conjugate acid-base pairs in acid-base reactions
5. define strength of acids and bases, and state factors that affect their strengths
6. name the common strong acids and bases
7. define ionization of acids and bases in water as the solvent, and write down the expressions for the ionization constants, K_a and K_b, for acids and bases
8. understand and define K_w and pH and to be able to perform related calculations.
9. define pH and pOH, and state the relationship between them
10. calculate the pH and pOH of a given acid or a base
11. define and explain buffers, and discuss their role in living systems
12. define indicators and discuss their use in titrations of acids and bases

Electrochemistry:

Students should be able to:

1. define and explain with examples oxidation, and reduction; and oxidizing and reducing agents
2. define and explain the concept of oxidation numbers (O.N.) and determine the oxidation number (O.N.) of an element in a given compound or ion using the rules for O.N.
3. split a given redox reaction into two half-reactions
4. balance a given skeletal redox reaction in acidic and basic media using half-reactions method.
5. define spontaneous and non-spontaneous reactions.
6. explain how to construct an electrochemical (also Voltaic or Galvanic) cell using a spontaneous redox reaction.

7. list all the parts of an electrochemical cell and identify the two electrodes – the anode and the cathode.
8. define reduction potential, E and standard reduction potential, E_0
9. calculate the standard potential difference, E_0 for a cell when the standard reduction potentials of the two half-reactions making up the cell are known
10. design a cell which uses a given redox reaction (or two half-reactions). Write the complete cell reaction, and calculate E_0 for the cell. Draw diagram for the cell listing all the parts and showing the direction of movement of all the charges
11. discuss the construction and electrode reactions of common batteries
12. define and explain electrolysis and electrolytic cell. Discuss the electrode reactions for the electrolysis of select molten and aqueous solutions. Discuss electroplating
13. state Faraday's laws of electrolysis, and discuss quantitative aspects of electrolysis relating charge, Q, (amount of electricity) to the current and the time
14. solve problems based on electrolysis
15. discuss corrosion, and describe methods to prevent corrosion (as time permits)
16. describe how the process of trial and error was used by early people to extract metals from ores (as time permits)

Organic Chemistry

Students should be able:

1. to define organic chemistry.
2. to recognize inorganic compounds containing C.
3. to recognize several functional groups such as: saturated and unsaturated aliphatic, aromatic hydrocarbon compounds, alcohols, aldehydes, ketones, carboxylic acids and esters.
4. to name common organic compounds using IUPAC system. Give formulas of common organic compounds and draw their structural, condensed structural, and line diagrams
5. Define and explain isomers.
6. to name saturated and unsaturated aliphatic (including cyclic) and aromatic compounds containing up to ten carbon atoms in the parent chain
7. to give the molecular formula of a hydrocarbon – saturated or unsaturated.
8. to define functional groups and identify common organic compounds based on their functional groups.
9. to write structural formula(s) for a compound with given molecular formula.

On completing this section, you should understand (at a basic level):

10. Carbohydrates
11. Polymer and monomers
12. Polymerization and hydrolysis
13. Lipids
14. Proteins
15. Biochemical reactions and enzymes
16. Nucleic acids

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

EVALUATION:

Lab Reports (2%each):	14%
Test 1:	5%
Test 2 – 5 (11% each):	44%
Final Exam:	37%
Total	100%

GRADING CRITERIA:

Alpha Grade	4-point Equivalent	Percentage Guidelines		Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	95-100		C+	2.3	66-69
A	4.0	90-94		C	2.0	63-65
A–	3.7	85-89		C–	1.7	60-62
B+	3.3	80-84		D+	1.3	54-59
B	3.0	75-79		D	1.0	50-54
B–	2.7	70-74		F	0.0	00-49

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It is recommended that you have a grade of 60 % or better to continue to post secondary courses

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Course Schedule/Timeline:

Days	Topics	Required Reading Ebbing 11th edition
	Review: Metric conversion, atomic structure, significant figures, etc.	15 – 28 CH 0110 Review
2	Review: Nomenclature, balancing equations, stoichiometry	CH 0110 Review 71 – 78, 88 – 99, 103 – 128,
	Molarity	131 – 140
	Thermochemical Changes	
4	Thermodynamics: Kinetic, potential, law of conservation of energy formulae and units	183 – 186
	Definition of system and surroundings	186 – 187
	Definition work (just in passing), heat and temperature, internal energy	187 – 188
	First law of thermodynamics (just in passing)	189
	Definition enthalpy relationship between enthalpy and heat	193 top & bottom blue box
	Writing thermochemical equations,& stoichiometry related problems	194 – 196
	Heat capacity, specific heat, problems.	198 – 210
4	Hess' law, solve problems	202 – 205
	Standard enthalpies of formation and problems	206 – 210
	Reaction Kinetics	
4	Reaction rates	442 – 443 13.1 para 1 only
	Transition state theory, activated complex, activation energy, and reaction coordinate. Diagrams for endothermic and exothermic reactions. Rates of reaction: Collision theory, factors affecting rates of reactions	462 – 466 omit formulae
	Catalyst	478 – 481
	Reaction mechanisms	468 – 469
	Rate determining step	473 – 474
	Chemical Equilibrium	
2	Chemical equilibrium: Irreversible and reversible reactions, equilibrium, equilibrium constant, factors affecting equilibrium.	487 – 518
2	LeChatelier's Principle	508

1	K_{sp}	583 – 588
	Acids and Bases	
.5	Electrolytes, nonelectrolytes	103 – 105
.5	Arrehenius acids Strong acids and bases	115, 521 – 522 117 – 118
3	Bronstad– Lowery acids and bases, conjugate acid-base pairs Strengths of acids and bases	116 522 – 525, 528 – 530
	Lewis acids and bases (Just in passing)	525 – 526
2	Self-ionization of water (K_w), pH and pOH, calculations of pH and pOH.	534 – 538,
	Indicators	114 – 115, 539 – 540
2	Ionization of acids and bases in water, K_a, K_b	544 – 558
1	Acid base properties of a salt solution Buffers	558 – 560 566 – 567
1	Titration curves	573 – 577
	Electrochemistry	
2	Spectator ions, net ion eq'ns,	109 – 113
2	Redox, oxidation numbers (O.N.)	146 – 155
4	REDOX in acidic and basic solutions	637 – 641
3	Electrochemical cells, batteries	642 – 656, 663 – 668
	Electrolysis	668 – 677
	Organic and Biochemistry Chemistry	
3	Hydrocarbons: alkanes, alkenes, alkynes, aromatic hydrocarbons, nomenclature, isomers	812 – 833
1	Functional groups: Alcohols, ethers, aldehydes, ketones, carboxylic acids, amines, amides and nomenclature and reactions.	834 – 839
	Polymers, monomers, biochemistry	842
	Carbohydrates, isomers, sugars, cellulose, starch	855 – 856

1	Lipids, fats, waxes, phospholipids, steroids	437
	Proteins and peptide bonds	849 – 853
	Nucleic acids, nucleotides, ribose sugar, and deoxyribose sugar, Nitrogen bases, RNA and DNA	856 – 861

STUDENT RESPONSIBILITIES:

Students will:

- Regular attendance is expected of all students, and is crucial to passing this course. Students who miss classes will soon find themselves falling behind and failing. Lateness will **not** be tolerated as it interrupts the instructor and fellow classmates.

- As per Department Policy, if you miss 10 or more classes per semester of classes in any course, you may be debarred from the final exam for that course.

- A certificate (a doctor's or a note from the funeral home) will be required to make up the midterm or final exam. **You will receive a grade of F if you miss the final.** Call if you are going to miss a test. There may be a deduction of 10% for test rewrites. The possession of any kind of listening and/or communication devices such as Cellular phones, iPhones, iPods, Tabs, Netbook, laptop computers and/or any other hand-held device capable of receiving/transmitting information falling under this category are not allowed in the room during tests or final exams. Possession of any such device could result in an F in the course.

- ***Very important:** **Laboratory attendance to each specific experiment is compulsory; a passing grade in the laboratory component is required to pass the course.** There are **NO** 'make up' labs in this course. Being absent from an experiment will result in a grade of **ZERO** for that experiment.

  Lab reports must be submitted on the required date and at the **required time**.
  Penalties for late **lab reports** are as follows:
  5 minutes – 10%, 24 hours – 20%, after that – 100%

- review material that is prerequisite to this course quickly so it does not slow you down. (See Assumed Background Knowledge on pages 2 & 3. Especially the section on nomenclature.)

- be at class regularly and on time. (If you miss more than 10 per semester of classes in any course, you may be debarred from the final exam for that course.)
- complete all pre class and pre-lab assignments before arriving in class.
- keep up with course material.
- if experiencing difficulties with course get help immediately.
- catch up on missed material before the next class.
- provide documentation for missed midterms or finals.
- be aware of penalty for failing the lab component and not writing the final.

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:
https://www.gprc.ab.ca/files/forms_documents/Student_Misconduct.pdf

Instructors reserve the right to use electronic plagiarism detection services on written assignments. **Instructors also reserve the right to ban the use of any form of electronics (cell phones, Blackberries, iPods, tablets, scanning pens, electronic dictionaries, etc.) during class and during exams.**

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

Additional Information (Optional):

**Note: all Academic and Administrative policies are available at
https://www.gprc.ab.ca/about/administration/policies/