Grande Prairie Regional College

Department: Academic Upgrading

COURSE OUTLINE – WINTER 2008
CH0130 5(5-0-1.5) HS Chemistry Grade 12 Equivalent

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Office Hours	M, W, R, and F 9:00 to 9:50 or by appointment		

Prerequisite:

CH 0120 or equivalent, and MA 0110 or equivalent

Textbook: General Chemistry by Ebbing and Gammon (8th Edition) Published by Houghton and Mifflin Company

Credit/Contact Hours:

CH 0130 is a 5-credit course with 5 hours/week lecture and 1.5 hr/week lab component.

Course Description:

The major concepts to be covered include stoichiometry – limiting reagents; gases; thermochemistry; reaction kinetics – chemical equilibrium; acids and bases; and electrochemistry. Energy changes in chemical reactions and safety are highlighted.

Attendance and Lateness:

Regular attendance is expected of all students because it is crucial to passing the course. Students who miss classes will soon find themselves falling behind and doing poorly in the course. Lateness will **NOT** be permitted as it disrupts the class. **You may be debarred from the final exam if your absences exceed 15% (10 days) of the course hours.**

Tests and Exams:

All tests and exams **MUST** be written at scheduled times unless **PRIOR** arrangements have been made with the Instructor. A missed test or exam will result in a mark of **ZERO** for that test (exam).

Labs:

Attendance is compulsory for all labs and students **MUST pass the lab component separately to pass the course.** A missed lab will result in a mark of **zero**. Makeup labs are **NOT** guaranteed and may be allowed only for valid reasons at the discretion of the Instructor and the Lab tech. All lab reports must be handed in before the deadlines announced. A one-day delay will result in a 2 marks while a two-day delay will cost you 3 marks. Labs handed in beyond the two-day lateness will not be graded unless **PRIOR** permission of the Instructor has been secured.

Evaluation:

The final grade in the course will be based on the following components:

4 tests	= 32% (Tests 1 and 3: 10% each. Tests 2 and 4: 6% each)
Midterm Exam	= 23%
Final Exam	= 25%
Labs	= 20%
TOTAL	**= 100%**

Grades will be assigned on the Letter Grading System.

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**

Course Objectives:

The following is the list of minimum objectives in the course that must be achieved over the semester. More objectives may be added as per the need. You are advised to do as many questions at the end of each topic as possible.

1. NOMENCLATURE AND STOICHIOMETRY (About 2 weeks)

Upon completion of this unit, you should be able to:

a. Name the common inorganic compounds (or ions) if their formulas are given.
b. Write formulas of the compounds (or ions along with their charges) for which the names are given.
c. Given the reactants and the products for a reaction, be able to write a balanced chemical equation.
d. Define the mole and the molar mass. Be able to convert the mass of a given substance into moles and vice versa.
e. Explain the difference between molar mass and molecular weight.
f. Interpret a given chemical equation in terms of moles and masses (volumes in case of gases as well) of all the reactants and the products.
g. Given the moles (or mass) of one or more of the reactants or products of a reaction, for which the balanced chemical equation is given, be able to calculate the moles or masses of all the other reactants and the products.
h. Explain the significance of standard temperature and pressure (STP) as applied to gases.
i. State the relation between the number of moles and the volume of a gas at STP, and use the relation in solving stoichiometric problems.
j. Explain the implication of limiting reagents, and solve problems involving limiting reagents

2. GASES (About 2 weeks)

Upon completion of this unit, you should be able to:

a. State the physical characteristics of gases, and discuss how they differ from solids and liquids.
b. State and explain the following gas laws: Boyle's, Charles', Avagadro's, the combined gas law, and the ideal (general) gas law. State the different units of R, the universal gas constant
c. Apply the above laws to solve problems
d. State the postulates of the Kinetic Molecular Theory (KMT) and explain their implications
e. State and explain Dalton's and Graham's laws and solve problems based on them
f. Define the density of gases, and be able to calculate the density of a gas at any temperature and pressure if its molecular weight (molar mass) is given.
g. Determine the molecular weight (molar mass) of a gas if its density is given.
h. Explain the difference between ideal and non-ideal behavior of gases. State the conditions under which real gases approach ideal behavior and all gases deviate from ideal behavior.

i. Explain intermolecular forces including van der Waal's forces, and how such forces cause deviation from ideal behavior of gases and cause their liquefaction

WRITE TEST 1

3. THERMOCHEMISTRY: ENERGY CHANGES IN CHEMICAL REACTIONS
(About 2 weeks)
Upon completing this unit, you should be able to

a. Define and explain the terms: system and the surroundings.
b. State and explain the First Law of Thermodynamics giving examples.
c. Explain the following terms: The internal energy, E, of a system, enthalpy, H, changes in enthalpy, ΔH, exothermic and endothermic reactions.
d. Explain the difference between the internal energy and enthalpy.
e. Define specific heat capacity, c, of a system, and give its relation to ΔH.
f. Explain bomb calorimeter, and how it is used to determine ΔH. Solve problems based on the relation: $\Delta H = mc\Delta T$
g. State and explain the following terms clearly: heat of formation, heat of reaction, heat of combustion, and heat of neutralization.
h. Give the mathematical relation between the heats of formation of the reactants and the products, and the heat of the reaction. Solve problems based on the two.
i. State and explain Hess' Law of constant heat summation, and solve problems based on it

WRITE TEST 2

WRITE MIDTERM EXAM

4. REACTION KINETICS AND CHEMICAL EQUILIBRIUM (About 2.5 weeks)
Upon completing this unit, you should be able to

a. Define the rate of a chemical reaction giving its units, and state the factors that affect the rate. Also draw the rate-time graph
b. State and explain Guldberg and Waage's law of mass action, and derive the formula for rate of reaction from the law.
c. Explain the following terms clearly: Rate law, and rate constant. Give the units of both. State the factors that affect the rate constant, k
d. Explain how the rate law of a reaction is determined as the rate of the slowest step
e. Discuss the effect of changing concentration of reactants on the rate of reaction.
f. Discuss the Transition State (or activated complex) theory of reaction rates with the help of diagram. Explain the energy of activation. Also explain how changes in temperature and addition of a catalyst affect the rate of reaction.
g. Explain reversible reactions, and chemical equilibrium.. Draw equilibrium diagram showing the rates of reactions. State conditions of equilibrium.

h. Explain equilibrium constant, K, in terms of the mass action expression. State the factors that affect K.
i. Write mathematical expression for K for any given reversible reaction. Solve problems based on chemical equilibrium.
j. Explain heterogeneous equilibria and write expressions for K for such equilibria.
k. Solve related problems
l. Discuss shifts in equilibrium when changes are introduced.
m. State Le Chatelier's Principle, and apply it to predict shifts in equilibria when different changes (concentration, temperature, volume, pressure etc.) are introduced to a system at equilibrium

5. ACIDS AND BASES (About 2 weeks)

Upon completing this unit, you should be able to

a. List common characteristics of acids and bases, and define neutralization.
b. Define acids and bases in terms of Arrhenius, and Bronsted and Lowry concepts.
c. Define and identify the conjugate base of a given acid and conjugate acid of a given base. Write a given acid-base equilibrium as conjugate acid-base pairs.
d. Explain dissociation or ionization of acids and bases. Write dissociation equations for acids and bases. Define dissociation (ionization) constants.
e. Define the strength of an acid and a base. State the factors that affect the strengths of acids and bases. List the common strong acids and bases.
f. Discuss the affect of the solvent on the strength of acids and bases.
g. Discuss the ionization of water, and ionization constant of water.
h. Define pH and pOH of aqueous solutions. Give the relation between the two, and calculate them for strong acids and bases.
i. Determine the ionization constants of week acids and bases if their pH values are known.
j. Calculate the pH and the pOH values of week acids and bases when their dissociation constants are known
k. Solve other related problems involving strengths and neutralization of acids and bases.
l. Define buffers, and explain the working of buffers

WRITE TEST 3

6. ELECTROCHEMISTRY (About 2.5 weeks)

Upon completing this unit, you should be able to

a. Explain the following terms clearly: Oxidation, Reduction, Oxidant, Reductant, and Redox reactions.
b. Identify the species undergoing oxidation and reduction in a given redox reaction. Also identify the oxidant and the reductant.
c. Balance redox reactions using half-reactions in acidic and basic media.
d. Define oxidation numbers and state rules to assign them. Calculate oxidation number of a particular element in a given ion or compound of the element.
e. Explain the principle and working of an electrochemical cell (Galvanic or Voltaic cell) with the help of a diagram. List all the parts of the cell and show migration of charges.
f Define electromotive force, emf, (potential difference) and give its units. Discuss how to determine it for a complete cell and for a half-cell.
g. Explain standard hydrogen electrode and standard emf, E^0
h. Given a skeletal reaction or two half reactions, explain how to design an electrochemical cell, and calculate its E^0 value. Draw the diagram of the cell.
i. Explain electrolysis and electrolytic cell. Discuss the electrolysis of select molten and aqueous solutions.
j. Define the Coulomb and the Faraday as units of charge, and state the relation between the two.
k. State the relation between the charge, Q, the current, I, and the time, t. Solve problems based on electrolysis.
l. Discuss the construction, and the electrode reactions for the following common batteries: Lead storage or the car battery; Ni-Cd battery; the common dry battery; the alkaline battery

WRITE TEST 4

WRITE FINAL EXAM

Statement on Plagiarism:
The instructor reserves the right to use electronic plagiarism detection services.