CHEMISTRY 0130

GRANDE PRAIRIE REGIONAL COLLEGE

Course Outline

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TEXT BOOK: Introductory Chemistry by Sevenair & Burkett

NATURE OF THE COURSE: This is a one semester course. It is basically a lecture course with two-hour lab per week.

GRADING: The final grade in the course will be awarded based on your performance on two major exams, three short exams, and the lab. The break down is as follows:

LAB	=	23%
FINAL	=	30%
MID TERM	=	20%
3 SHORT EXAMS	=	27%

IMPORTANT NOTES:

1. You **MUST** pass the lab component separately to pass the course. You may be debarred from writing the final exam if you fail the lab component. Avoid missing labs. There is no guarantee that you will be allowed to make up the missed labs. A maximum of 2 make up labs may be allowed, but only for valid reasons. A missed lab will result in a score of zero.

2. All exams must be written at the scheduled times unless **PRIOR** arrangements have been made with the instructor. All missed exams will result in a score of zero each.

3. The students must meet the prerequisites for the course.

ATTENDANCE: Attendance is compulsory in the course. A student with 20% or more unexcused absences in lecture and/or lab may be refused to write the final exam. Lateness or tardiness is highly discouraged.

COURSE CONTENT: The following topics will be covered over the semester. The numbers in the parentheses indicate the corresponding chapter(s) of the text. Please do as many questions as possible at the end of each chapter.

1. **REVIEW:** (7, 8 and 9) Upon completion of the review, you should be able to:

   a) Name most of the inorganic compounds if their formulas are given.
   b) Write formulas of inorganic compounds for which names are given.
   c) Given the reactants and the products, be able to write a balanced chemical equation.
   d) Interpret a given chemical equation in terms of masses and moles of all the reactants and the products.
   e) Given the mass (or moles) of one or more of the reactants or products, be able to calculate the mass or the number of moles of the rest of the reactants or products of a given chemical equation.
   f) State the relation between the mole and the volume of a gas at S.T.P. and use it in problem solving.
   g) Solve stoichiometric problems when a reactant is present in limiting amounts.

2. **GASES:** (11) Upon completion of this topic, you should be able to:

   a) State the physical characteristics of gases.
   b) State and explain gas laws of Boyle, Charles, Avagadro, the combined gas law, and the ideal gas law. State the units of R for different units of pressure.
   c) State the postulates of the Kinetic Molecular Theory.
   d) State and explain Dalton's and Graham's laws.
   e) Solve problems based on all the above laws.
   f) Explain the difference between ideal and non-ideal behavior of gases. State the conditions under which real gases approach ideal behavior.
   g) Explain intermolecular forces including Van der Waal's forces, and how such forces cause deviation from ideal behavior in gases.

3. **ENERGY CHANGES IN CHEMICAL REACTIONS:** (4) Upon completion of this topic, you should be able to:

a) Define and explain a system and surroundings.
b) Explain enthalpy, changes in enthalpy, exothermic and endothermic reactions.
c) Determine ΔH using the bomb calorimeter.
d) State and explain the following terms clearly: heat of reaction, heat of formation, heat of combustion, heat of neutralization. State the relationship between the heat of formation and heat of reaction. Solve related problems.
e) State and explain Hess' law of constant heat summation and apply it to calculate heats of reactions.
f) Solve other related problems.

NOTE: This topic is NOT covered well in the text.

4. **CHEMICAL KINETICS:** (14) Upon completion of this topic, you should be able to:

a) Define the rate of a chemical reaction and state the factors that affect the rate. Also be able to draw a rate-time diagram.
b) State and explain the following terms clearly: rate law, rate constant, and the factors that affect it.
c) Express the rate of a reaction in terms of the rate constant and the molar concentrations of the reactants. Discuss implications and applications of rate law.
d) Explain the following terms in detail: transition state theory, activated complex, energy of activation and reaction coordinate. Be able to draw diagram showing all these quantities.
e) Explain the effect of temperature and catalyst on the rate of a reaction using transition state theory.

5. **CHEMICAL EQUILIBRIUM:** (14) Upon completion of this topic, you should be able to:

   a) State and explain the following terms clearly: reversible reactions, law of mass action, chemical equilibrium.
   b) State and explain equilibrium constant and the factors on which it depends. Write mathematical expression for equilibrium constant for a given reaction.
   c) Given the equilibrium concentrations of the reactants and the products, be able to calculate the equilibrium constant. Conversely, given the value of the equilibrium constant and the concentrations of some of the reactants and the products, be able to calculate the concentrations of the rest of the species in a reaction at equilibrium.
   d) State the factors that affect chemical equilibrium.
   e) State and explain LeChatelier's principle and apply it to predict shifts in chemical equilibrium.
   f) Explain heterogeneous equilibria and write the expression for the equilibrium constant for heterogeneous equilibria.
   g) Solve related problems.

6. **ACIDS AND BASES:** (15) Upon completion of this topic, you should be able to:

   a) Define acids and bases in terms of both, the Arrhenius, and the Bronsted-Lowry concepts.
   b) Define and identify the conjugate base of a given acid and vice versa.
   c) Define the strength of an acid and a base; and be able to list factors that affect the strength of an acid or a base.
   d) Explain dissociation, and dissociation constant of an acid and a base. Write equations for both. Be able to list strong acids and bases.
   e) Explain ion product of water. Define the pH of a solution and be able to compute pH from a knowledge of hydrogen ion concentration and vice versa. Explain pOH and state the relation between pH and pOH.
   f) Compute the pH and pOH of strong acid and base solutions.
   g) Compute the dissociation constants of weak acids and bases if pH or pOH values are given.
   h) Compute the pH or pOH of weak acid or base solutions if the related dissociation constants are given.
   i) Solve other related problems involving acids and bases.

7. **ELECTROCHEMISTRY:** (16) Upon completion of this topic, you should be able to:

a) Explain the following terms in detail: oxidation; reduction; oxidant; reductant; oxidation number; redox reactions.
b) Identify the oxidant, the reductant, the oxidized and the reduced species in a redox reaction.
c) Balance a redox equation using half reactions.
d) Explain the principle and working of a Galvanic Cell. Be able to draw a diagram for such a cell, labelling all parts and showing the direction of the electron flow and the migration of ions.
e) Explain the following terms in detail: standard reduction (or oxidation) potential for a reaction (or a half reaction); EMF of a cell.
f) Design a cell by combining two half reactions and be able to calculate its EMF if electrode potentials are known.
g) Explain standard hydrogen electrode.
h) Explain electrolysis, and Coulomb and Faraday units of charge.
i) Solve problems based on electrolysis.
j) Write the overall and net reactions for the electrolysis of common electrolytes.
k) List the parts of the following batteries and write the electrode half reactions and the overall reactions for them: lead storage battery; nickel-cadmium battery; common dry battery; and the alkaline battery.