Bossier Parish Community College
Master Syllabus

Course Prefix and Number: CHEM 102   **Credit Hours:** 3

Title: General Chemistry II

Course Prerequisites: Chemistry 101

Textbook: Chang, R. and Goldsby, K.; <u>General Chemistry, The Essential Concepts,</u> 7th Edition

Course Description:
      This course will provide the student with a continuing study of chemistry concepts by building on concepts covered in CHEM 101. Topics include intermolecular forces, thermodynamics, general and heterogeneous equilibrium, kinetics, solutions, acid/base equilibrium and properties, and electrochemistry.

Learning Outcomes:

At the end of this course the students will:

   A.   utilize algebraic skills to quantify and predict chemical and energy changes;
   B.   apply knowledge of the structure and behavior of atoms and molecules to explain physical properties of matter, predict rates of reactions and explain electron transfer; and
   C.   apply chemical concepts to comprehend the properties of nuclear energy.

To achieve the learning outcomes, the student will

   1.   relate polarity of bonds to dipole moments and be able to predict the occurrence of dipole moments. (B)
   2.   determine the type of intermolecular forces, known as Van der Waals forces that are present in molecules and be able to describe the chemical structures responsible for each of these forces. (B)
   3.   predict the occurrence of hydrogen bonding and predict the effect hydrogen bonding will have on the physical properties of the compound. (B)
   4.   list the 6 phase changes and describe the physical state at the beginning and end of each phase change. (B)
   5.   associate a free energy change with any phase change and calculate the enthalpy component and the entropy component for that change. (A,B)
   6.   define the terms vapor pressure, normal boiling point and evaporation and be able to calculate vapor pressure of a liquid at various temperatures using the Clausius-Clapeyron equation. (A,B)
   7.   classify solids into molecular and network types and give examples of each. (B)
   8.   calculate density, radius, or determine the unit cell of a metal given the other two. (A,B)
   9.   describe the three types of homogeneous mixtures. (B)

10. relate the dissolution of a substance in a solvent to a free energy change and its two components, enthalpy and entropy. (A,B)
11. interconvert the units of concentration, molarity, mole fraction, weight (mass) percent, parts per million and parts per billion, molality. (A,B)
12. predict the effect of temperature or pressure on solubility. (B)
13. calculate the colligative effects on the solvent, given a concentration of solute. (A,B)
14. give examples of the use of colligative properties. (B)
15. plot reactant concentration vs. time and determine reaction rate at any interval. (A,B)
16. predict the rate of any reactant/product from a balanced equation. (B)
17. derive a rate law from experimental data for any reaction. (B)
18. use rate data to determine if a reaction follows the integrated form of the first-order rate law. (A,B)
19. determine half-life for a first order rate reaction, and predict the reactant concentration at any time given the rate constant, k. (A,B)
20. relate the lowing of the activation energy of a reaction to the type of catalyst used. (B)
21. write an equilibrium expression for any chemical reaction relating the equilibrium constant (K_c) to the concentrations of the reactants and products. (A,B)
22. write an equilibrium expression for any gas-phase reaction relating the equilibrium constant (K_p) to the partial pressures of the reactants and products. (A,B)
23. write an equilibrium expression for a reaction in which the reactants or product are present in different phases, that is a heterogeneous equilibria. (A,B)
24. judge the extent of a reaction from the value of the equilibrium constant and predict the direction of a reaction from a reaction quotient, Q_c. (A,B)
25. calculate an unknown equilibrium concentration of either a reactant or product from the known concentrations or from initial concentrations of a reaction. (A,B)
26. predict the effect of changing conditions on an equilibrium mixture. (A,B)
27. compare the reaction rates of catalyzed and uncatalyzed chemical reactions. (B)
28. relate the rate constants for the forward and reverse reactions to the equilibrium constant. (B)
29. compare the Arrhenius theory of acids and bases to the Bronsted-Lowry theory of acids and bases and realize why the Bronsted-Lowry theory of acids and bases is more generalized. (B)
30. relate acid strength and base strength in terms of conjugate acid-base pairs. (A,B)
31. relate the dissociation of water to the pH scale, understand the measurement of pH and how it relates to the hydronium ion. (A,B)
32. calculate the pH of a solution of strong acid or strong base. (A,B)
33. calculate the equilibrium concentrations in solutions of weak acids or weak bases. (A,B)
34. relate percent dissociation of acids to the strength of a weak acid. (B)
35. calculate the equilibrium concentrations of all species in solutions of polyprotic acids. (A,B)
36. calculate K_a (or K_b) for a conjugate acid-base pair given K_b (or K_a). (A,B)
37. calculate the pH of a solution of a salt of a weak acid or base. (A,B)
38. compare the Arrhenius and the Bronsted-Lowry theories of acids and bases to the Lewis theory of acids and bases and realize why the Lewis theory of acids and bases is even more generalized and currently accepted. (B)

39. predict the results of neutralization reactions with different combinations of strong acids, weak acids, weak bases, and strong bases. (B)
40. explain the common ion effect and its use in buffer solutions. (B)
41. make calculations with the Henderson-Hasselbalch equation to predict pH or ion concentration. (A,B)
42. calculate or plot data to obtain pH titration curves with different combinations of strong acids, weak acids, polyprotic acids, weak bases, and strong bases. (A,B)
43. measure K_{sp} and calculate a substance's solubility from K_{sp}. (A,B)
44. predict when ionic compounds will precipitate, and devise separation procedures using selective precipitation. (B)
45. state the second law of thermodynamics and know how it relates to spontaneous processes. (B)
46. calculate standard free energy changes. (A,B)
47. write half reactions for galvanic cells for both oxidation and reduction. (A,B)
48. use standard reduction potentials to predict the cell potential for different batteries. (B)
49. use the Nerst equation to predict pH of solutions and understand and be able to explain how a modern pH meter works. (B)
50. determine the composition of several common battery types. (B)
51. determine the chemical reactions involved in the corrosion process and give chemical rationales for the prevention of corrosion. (B)
52. relate the use of electrolysis and electrolytic cells to the preparation of pure chemicals. (B)
53. calculate the energy required to prepare a given amount of chemical by electrolysis. (A,B)
54. predict the properties of transition metals and write their electron configurations and calculate their oxidation states. (A,B)
55. name coordination compounds and describe their geometry. (B)
56. state the crystal field theory. (B)
57. distinguish nuclear reactions from chemical reactions. (C)
58. relate nuclear chemistry to alpha radiation, beta radiation, gamma radiation, positron emission and electron capture. (C)
59. calculate radioactive decay rates. (A,C)
60. predict the range of nuclear stability. (C)
61. distinguish nuclear fission from nuclear fusion. (C)
62. state biological effects of radiation. (C)
63. state applications of nuclear chemistry. (C)

Course Requirements

In order to receive a grade of "C" the student must earn 70% of the total possible points for the courses and achieve all of the following course requirements.

- minimum average of 70% on tests
- minimum of 50% on the comprehensive final test
- satisfactory completion of homework (70%) assignments

Course Grading Scale:

A- 90% or more of total possible points with a minimum average of 70% on tests and a minimum of 50% on the comprehensive final test and satisfactory completion of homework.

B- 80% or more of total possible points with a minimum average of 70% on tests and a minimum of 50% on the comprehensive final test and satisfactory completion of homework.

C- 70% or more of total possible points with a minimum average of 70% on tests and a minimum of 50% on the comprehensive final test and satisfactory completion of homework.

D- 60% or more of total possible points with a minimum average of 60% on tests and a minimum of 50% on the comprehensive final test and satisfactory completion of homework.

F- less than 60% of total possible points or less than a 60% average on tests or less than a 50% on the comprehensive final test or failure to satisfactory complete homework.

Attendance Policy: The college attendance policy is available at
http://www.bpcc.edu/catalog/current/academicpolicies.html

Nondiscrimination Statement

Bossier Parish Community College does not discriminate on the basis of race, color, national origin, gender, age, religion, qualified disability, marital status, veteran's status, or sexual orientation in admission to its programs, services, or activities, in access to them, in treatment of individuals, or in any aspect of its operations. Bossier Parish Community College does not discriminate in its hiring or employment practices.

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Equity/Compliance Coordinator
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Reviewed: D. Hoston 04/2022