COURSE OUTLINE : CHEM 102
D Credit – Degree Applicable
COURSE ID 004010
Cyclical Review: March 2021

COURSE DISCIPLINE : CHEM

COURSE NUMBER : 102

COURSE TITLE (FULL) : General Chemistry B

COURSE TITLE (SHORT) : General Chemistry B

CCC ACADEMIC SENATE DISCIPLINE: Chemistry

CATALOG DESCRIPTION

CHEM 102 is the second course in a two-semester sequence which covers important chemistry concepts including physical properties of matter, chemical reactions, stoichiometry, electronic structure of atoms, quantum mechanics, chemical bonding, and the three phases of matter. Lecture and laboratory activities are integrated into one cohesive lecture-lab section. The latter part of the course covers solution chemistry with emphasis on chemical kinetics, thermodynamics, and electrochemistry. Laboratory activities supports the above-mentioned topics, including both qualitative and quantitative analysis of data and propagation of errors.

Total Lecture Units: 3.00

Total Laboratory Units: 2.00

Total Course Units: 5.00

Total Lecture Hours: 54.00

Total Laboratory Hours: 108.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 162.00

Total Out-of-Class Hours: 108.00

Prerequisite: CHEM 101 with a grade of “C” or better.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1				describe the scientific method and apply it to the development of the science of chemistry;	No
2				evaluate past and present atomic theories with respect to experimental observations;	No
3				describe chemical processes in terms of chemical equations and be able to use the equations to answer quantitative questions concerning the process described;	No
4				describe the relationship between matter and energy and the inter-conversion of the two;	No
5				analyze modern theories of atomic motion, especially as they apply to gases;	No
6				use quantum theory to predict electronic structures of the atom;	No
7				analyze the properties of the elements and develop algorithms for the classification of the elements into logical groups;	No
8				utilize bonding theories to describe the chemical nature of ions and molecules;	No
9				demonstrate an understanding of intermolecular forces and apply those forces to the nature of solids and liquids;	No
10				demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.	No

EXIT STANDARDS

1 describe the fundamental properties of solutions and apply theories of colligative properties;
2 apply principles of electron transfer to understand oxidation and reduction processes;
3 distinguish between the rate of a reaction and the potential for a reaction to occur;
4 apply the fundamentals of collision theory to the rate at which a reaction proceeds;
5 analyze the effects of changes in system conditions on the amount of reactants and products present in the system;
6 identify acids and bases, and evaluate the effects that they may have on the properties of a solution;
7 analyze the composition of solutions based on properties of the components, including solubility, complex ion formation and redox;
8 apply the laws of thermodynamics to chemical systems and predict the direction in which chemical reactions proceed;

9 apply the laws of thermodynamics to analyze the ability to obtain work from a chemical process;
10 describe the method by which electrical energy may be obtained from chemical systems;
11 apply redox properties of substances to the development and understanding of batteries, corrosion, and fuel cells;
12 evaluate the interactions by which coordination compounds are stabilized;
13 identify nuclear reactions and predict nuclear stability as well as recognize the dangers of radioactivity;
14 continue to demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

STUDENT LEARNING OUTCOMES

1 solve quantitative chemistry problems including problems in solutions, chemical equilibriums, chemical kinetics, and electrochemistry
2 apply models of atomic behavior to explain general properties of matters such as colligative properties of solutions, crystal field theory, collision theory, and entropy
3 identify ions in solution using qualitative analysis
4 integrate concepts of equilibria, electrochemistry, and thermodynamics into explaining the spontaneity and direction of chemical reactions
5 apply chemical principles to practical applications such as batteries, electrolysis, corrosion, colors of compounds, and biological processes
6 analyze experimental data sets and graphs to obtain quantities related to kinetics, equilibrium, and acid-base chemistry
7 demonstrate reasoning in solving chemistry problems
8 integrate multiple ideas in the problem solving process

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	Properties of Solutions • The dissolving process • Concentration units • Temperature and solubility • Colligative properties	12	8	20

2	Acid and Bases • Properties of acids and bases • Arrhenius definitions • Bronsted-Lowry definitions • Lewis definitions • Autoionization of water • the pH scale • Strengths of acids and bases	10	8	18
3	Chemical Kinetics • Rate defined • First and second order differential rate laws • First and second order integrated rate laws • Activation energy and temperature • Catalysis • Orientation leading to successful reactions • Equilibrium - when the net rate equals zero • Mechanisms	10	8	18
4	Chemical Equilibrium • Writing the equilibrium constant expression • Writing the equilibrium constants and concentrations • Le Chatelier's Principle • Weak acids and weak bases • Diprotic and polyprotic acids • Salts containing acidic and basic ions that hydrolyze • Common ion effect and buffer solutions • Titrations and indicators • Solubility products • Molar solubility • Predicting the formation of precipitates precipitation reactions • Fractional precipitation • Solubility in solutions containing a common ion • pH and solubility • Complex ion equilibriums	10	8	18

5	Coordination Compounds • Nomenclature • Isomerims • Valence Bond and crystal field theories	4	8	12
6	Thermodynamics • Definitions • Entropy • Gibbs free energy • Free energy and equilibrium	4	8	12
7	Electrochemistry • Balancing redox reactions • Galvanic cells • Standard electrode potentials • Cell potential, electromotive force • Nernst equation and concentration cells • Batteries • Corrosion • Electrolysis	2	10	12
8	Nuclear Chemistry • Elementary particles • Nuclear binding energy • Radioactivity • Dating by radioactive decay • Fission • Fusion • Biological effects of radiation	2	16	18
9	Organic Chemistry • Hydrocarbons • Functional groups	0	34	34
				162

OUT OF CLASS ASSIGNMENTS

1 laboratory reports;
2 supplementary readings from handouts;

METHODS OF EVALUATION

1 four to six one-hour exams;
2 quizzes;
3 laboratory reports;
4 final exam with essay questions.

METHODS OF INSTRUCTION

- [x] Lecture
- [x] Laboratory
- [ ] Studio
- [ ] Discussion
- [ ] Multimedia
- [ ] Tutorial
- [ ] Independent Study
- [ ] Collaboratory Learning
- [x] Demonstration
- [ ] Field Activities (Trips)
- [ ] Guest Speakers
- [ ] Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Chemistry in the Laboratory	Required	W.H. Freeman	7	print	Postma, James M., et al.	1429219548	2009
Chemistry The Central Science.	Required	Prentice Hall/ Pearson	11	print	Brown, T.E. and H. E. LeMay	0-13-600617-5	2009