GENERAL CHEMISTRY (EBS 132) COURSE OUTLINE

CONTEXT

Chemistry forms an integral part of our lives. It touches the lives of every individual through agriculture, industry, nutrition, medicine, and home. An understanding of Chemistry is required to address major issues facing humanity. Therefore, the teaching of Chemistry should be done in such a way that students are presented the everyday relevance, or context, up front. This course will expose the student to acquire knowledge, skills and attitudes in topics such as Atomic Structure, Ionic and Covalent Compounds, The Mole, Chemical Formula and Equations, Acids, Bases and Salts, and the Chemistry of Carbon Compounds. In addition, this course will aim to bridge the gap between industrial and academic chemistry. Activity aids such as visits to industries will be encouraged to help students to give meaning to concepts, rules and laws, and activities in the classroom. The course will directly engage students in developing the reading, writing, and critical thinking skills and creativity promoted by the standards. The teaching and learning of Chemistry will be done in such a way that new concepts are presented in real-life (outside the classroom) situations and experiences that are familiar to the students. The examples and student exercises should be presented in the context of their use. These should include many real, believable problem-solving situations that students can recognize as being important to their current or possible future lives. The students should be encouraged to gather and analyze their own data as they are guided in discovery of the important concepts. Therefore, teachers should create opportunities for students to gather and analyze their own data for enrichment and extension. The lessons and activities should encourage the student to apply concepts and information in useful contexts, projecting the student into imagined futures. The students are expected to participate regularly in interactive groups where sharing, communicating, and responding to the important concepts and decision making occur. The lessons, exercises and laboratory work improve students' reading and other communication skills in addition to scientific reasoning and achievement.

Course Title				General Chemistry			
Course Code	EBS 132	Course Level	100	Credit value	3	Semester	2
Pre-requisite				Students have acquired knowledge in Senior High School Elective Chemistry			
Course Delivery Modes	Face-to-face	Practical Activity	Work-Based Learning	Seminars	Independent Study	e-learning opportunities	Practicum
Course Description for significant learning (indicate NTS, NTECF, BSC GLE to be addressed)				This chemistry course is designed to consolidate and expand on the content and skills students have acquired from their lessons in Integrated Science at the Senior High level. It also reflects some of the topics treated at the basic school level. The topics will be studied at the level that is slightly above that of elective Chemistry at the Senior High School. Topics studied in this course include atomic structure, electronic energy levels, acids basis and salts, and aspects of chemistry of carbon compounds. The approaches that would be used in the delivery of this course should prepare trainees to ensure the learning progress of all students by projecting gender roles and issues relating to equity and inclusivity. (NTS 2a, 2b, 2c,2e. 2f,p.13; 3e-3o, p.14; NTECF Pillar 1)			

Course Learning Outcomes: including INDICATORS for Each learning outcome	Outcomes The course will enable students to:	Indicators
CLO 1: (a) describe the structure of the atom in terms of protons, neutrons and electrons (NTS 2b, 2c, 2e p. 13, 3h, 3j, p. 14).	a. Describe protons, neutrons and electrons b. Describe the structure of the atom	
CLO 2: write the electronic configuration of each of the first twenty elements of the periodic table (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	a. Tell the atomic number of the first twenty elements b. Write the electronic configuration of the first twenty elements of the periodic table	
CLO 3: explain the difference between covalent and ionic compounds (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	a. Use two examples to describe the formation of ionic compounds in term of electron shifts or transfer of electrons. b. Illustrate the formation of ionic compounds c. Discuss the properties of ionic compounds d. Use two examples to describe the formation of covalent compounds in term of electron sharing. e. Illustrate the formation of covalent compounds f. Discuss the properties of covalent compounds g. Differentiate between ionic and covalent compounds	
CLO 4: define the mole as a unit of measurement of amount of substance (NTS 2b, 2c, 2e p. 13, 3h, 3j, p. 14).	a. Define the mole as a unit. b. Relate the mole to the amount of substance and number of entities/particles (atom, molecules, ion, electron etc.) c. Use the relative atomic masses of one mole of a given compound to calculate the formula mass (molar mass): carbon dioxide (CO_2), water (H_2O), sodium chloride (NaCl), sugar ($C_{12}H_{22}O_{11}$)	
CLO 5: write the formulae of common compounds and a balanced equation for simple reactions (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	a. Use the periodic table to illustrate symbols representing their respective elements (e.g. Magnesium-Mg, Aluminium-Al, Sodium-Na, Hydrogen-H etc.) b. Indicate that the symbol represent the atoms of an element. c. Write the formulae of four common compounds d. Outline the steps in writing a chemical equation e. Write a balanced chemical equation for a simple reaction f. Indicate the symbols (g = gas ; l = liquid ; s =solid ; aq. = in water solution) to denote the state of a substance in an equation	

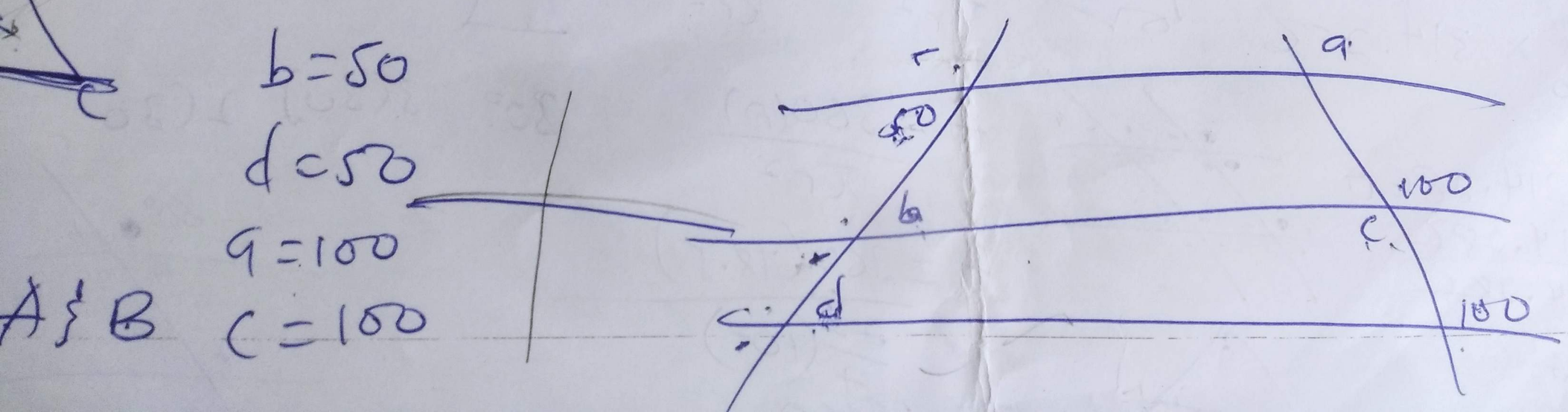
CLO 6: separate mixture by distillation, sublimation, chromatography, evaporation and magnetization (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	• Describe at least four methods of purification of impure compounds • Separate impure compounds using at least two methods
CLO 7: describe acids, bases and salts (NTS 2b, 2c, 2e p. 13, 3h, 3j, p. 14).	a. Define acids, bases and salts b. Describe the physical properties of acids, bases and salts c. Describe the behavior of acids and bases in water d. Explain the conductance of molar solutions of strong and weak acids and bases.
CLO 8: classify and name different types of organic compounds (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	a. group given organic compounds into alkanes, alkenes, alkynes, alkanols and alkanoic acids b. write the names of given organic compounds
CLO 9: describe the structures of different organic compounds (NTS 2b, 2c, 2e p. 13, 3h, 3j, p. 14).	a. tell the differences in the structures of different organic compounds b. draw the structures of given organic compounds c. describe structural (chain, position and functional group) and geometric isomerism
CLO 10: discuss the chemical and physical properties of organic compounds (NTS 2c, 2e, 2f. p. 13, 3h, 3j, p. 14).	a. describe the chemical and physical properties of organic compounds b. compare the chemical and physical properties of organic compounds
CLO 11: describe the preparation and uses of organic compounds (NTS 2a, 2b, 2c, 2e. 2f, p.13; 3e-3o, p.14)	a. explain the laboratory preparation of three named organic compounds b. describe the uses of three named organic compounds

Units	Topics	Sub-topics (if any):	Teaching and learning activities to active learning outcomes
1	STRUCTURE OF THE ATOM AND ARRANGMENT OF ELECTRONS	a) Gross features of the atom b) Arrangement of electrons in the main and sub-energy levels c) Atomic number, mass number, isotopes and atomic mass	• Use cooperative method (think-pair-share) to discuss and explain the gross features of the atom • Animation and simulations of structure of the atom and how electrons are arranged in the main orbitals • Use games and songs/acronyms to learn about the 1st 20 elements • Class discussion of the following terms: atomic number, number of protons, mass number and atomic mass

2	FORMATION OF IONIC AND COVALENT COMPOUNDS	a) Ionic bonds b) Covalent bond	• Using individual and group presentations (being mindful of gender roles) to describe the formation of ionic compounds in term of electron shifts or transfer of electrons with examples
Using individual and group presentations (being mindful of gender roles) to illustrate the formation of ionic compounds • Class discussion on the properties of ionic compounds • Using individual and group presentations (being mindful of gender roles) to describe the formation of covalent compounds in term of electron sharing • Using individual and group presentations (being mindful of gender roles) to illustrate the formation of covalent compounds • Class discussion on the properties of ionic compounds • Student presentation on the differences between ionic and covalent bonds			
3	MOLE AS A UNIT AND FORMULA MASS	a) The mole as a unit b) Formula mass	• General class discussion on the mole concept • Student presentation on calculations involving the mole • Questions and answers technique can also be employed where appropriate (being mindful of equity and inclusivity).
4	CHEMICAL FORMULA AND EQUATION	a) Chemical Symbols and formula b) Chemical equation c) Balancing equations and state symbols	• Use game and songs/acronyms to learn the symbols and chemical formulae of elements and compounds respectively • Use lecturette method to explain chemical reactions, chemical equations and balancing of chemical equations • Individual and group work on balancing of chemical equations
• □ Student presentation on balancing of chemical equations			

b. Isomerism	• Class discussion of chain isomerism • Computer molecular modelling of structural and geometric isomerism to be followed by a class discussion of structural isomerism (chain, position and functional group isomerism) and geometric isomerism (cis and trans isomerism) • Student presentation on the differences between structural and geometric isomerism.
c. Alkanes, Alkenes and Alkynes i. Sources/ preparation ii. Physical and chemical properties iii. Reactivity iv. Uses	• Using cooperative learning (think-pair-share and group work) • Using individual and group presentations (being mindful of gender roles) • General class discussion • Videos and computer simulations
d. Alkanols and Alkanoic acids (i) Sources/ preparation (ii) Structure and shape (iii) Physical and chemical properties (iv) Uses (v) Petroleum	• Using cooperative learning (think-pair-share and group work) • Using individual and group presentations (being mindful of gender roles) • General class discussion • Videos and computer simulation • Visit to industrial sites to interact with workers, observe and discuss the application of Organic Chemistry in the industry
□ Write a report on the industrial visit for a general class discussion	
Course Assessment (Educative assessment: of, for and as learning)	**Component 1**: Formative assessment (quizzes, class tests, class exercises, and assignments) Summary of Assessment Method: Quizzes, class test, class exercises and assignments on Units 1, 3 and 4 (core skills to be developed: critical thinking , creativity, and personal development) Assessment Weighting: 10% Assesses Learning Outcomes: CLO 1, 2, 4 and 5 (Units 1, 3 and 4)

Component 2: Formative assessment (individual and/orgroup presentations) Summary of Assessment Method: Individual and/or group presentations on Unit 2, 4, 5, 6 and 7 (core skills to be developed are effective communicative skills, collaborative skills, and critical thinking skills). Students will be involved in assessing their colleagues (peer assessment) Assessment Weighting: 30% Assesses Learning Outcomes: CLO 3, 5, 6, 7, 8, 9, 10 and 11 (Units 2, 4, 5, 6, and 7)	
Component 3: Summative assessment Summary of Assessment Method: End of semester examination (composed of multiple choice questions and essay-type questions) on Units 1 to 7 (core skills to be developed: critical thinking, creative thinking, problem solving, innovation, and personal development) Weighting: 60% Assesses Learning Outcomes: CLO 1-11 (Units 1 – 7)	
Instructional Resources	1. Charts, pictures and models. 2. Computers and projectors, television, and living objects. 3. Excursions and visits, exhibitions and fairs, and experimentation in the laboratory and work-shop
Required Text (core)	Ameyibor, K., &Wiredu M. B. (1991).*GAST chemistry for senior secondary school*. London: Macmillan Education Limited. Chang, R. (2003). *General chemistry: The essential concepts*. (3rded.). Boston: McGraw Hill. Dadson, B.A. (2008). *The first course in organic chemistry*. Cape Coast: Risoprint Enterprise. Gallagher, R. & Ingram, P. (1987).*Chemistry made clear*. Oxford: Oxford University Press. Ohia, G.N.C., Amasiatu, G.I., &Ajagbe, J.O. (2005).*Comprehensive certificate chemistry*. Ibadan: University Press PLC.



5	PURE AND IMPURE SUBSTANCES AND MIXTURES	a) Pure and impure substances b) Methods of purification of impure substances c) Importance of purification of impure substances	□ Student presentation on the definition of pure and impure compound with examples • Class discussion on the methods of purification of impure compounds • Student demonstration of at least two methods of purification of impure substances • Class discussion of the importance of purification of impure compounds • Visit to industrial sites to interact with workers, observe and discuss the application of purification of impure substances • Students present a report on the industrial visit for a general class discussion
6	ACIDS, BASES AND SALTS	a) Definition of acids and bases b) Physical and chemical properties of acids and bases c) Acids, bases and salts as electrolytes d) pH e) Weak acids and weak bases f) Hydrolysis g) Acid-Base indicators h) Acid-base titrations	□ Using concept mapping and cartooning for illustrating and discussing the concepts of acids, bases and salts. • Using individual and group presentations • Using 'spider web' as a strategy to present the classification of acids and bases. • Videos, computer simulations and whole class discussion can be used for presenting the concept on pH scale and titration. • Visit to industrial sites to interact with workers, observe and discuss the application of acids, bases and salts • Students present a report on the industrial visit for a general class discussion
CHEMISTRY OF CARBON COMPOUNDS	a. Classification and nomenclature of alkanes, alkenes and alkynes		• Using cooperative learning (think-pair-share) let students discus the classification of hydrocarbons and explain the basic rules for naming hydrocarbons • Use gaming/simulation method to illustrate the functional groups of alkanes, alkenes and alkynes