Lead City University, Ibadan
Faculty of Sciences
Department of Biochemistry

COURSE PARTICULARS

Course Title: General Chemistry II
Course Code: CHM 112
No. of Units:
Status: compulsory/elective

LECTURER DETAILS

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Name: **Mr. Ilesanmi S.O.**
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COURSE DESCRIPTION

Chemistry of Aromatics, Heterocyclic Hydrocarbon & Introductory Natural Products is a specialized branch of organic chemistry which studies the chemical composition of various biological products like; alkaloids, terpenoids, steroids and vitamins. These natural products, both from plants and animals, have found uses in industries like; pharmaceutical, food, brewery etc. The course also helps to appreciate the synthesis of these natural products and their various chemical reactions.

COURSE OBJECTIVE

The course is meant to be a link from the general organic compound chemistry to that of drugs, thereby preparing the students for studies in drug related courses. The students were also to appreciate the chemistry of naturally occurring drugs like *quinine* in the bark of cinchona tree and some other plants whose roots have some medicinal importance.

ASSESMENT

Class Attendance	5marks
Test(s) and Assignments	25marks
Final Examination	70marks

LECTURE PLAN

Week	Topic
1	History survey of the development and important of Organic Chemistry
2	Homologous Series.
3	Nomenclature and Classes of Organic compounds.
4	Functional groups.
5	Isolation and Purification of Organic Compound.
6	Qualitative and Quantitative of Organic Compound.
7	Stereochemistry.
8	Determination of structure of organic compound.
9	Electronic theory in organic chemistry.
10	Saturated and Unsaturated hydrocarbon.
11	Week 11: Periodic table and Periodic Properties.
12	Week 12: Chemistry of Selected Metals and Non-metals and their qualitative analysis.

READING LIST

1. Alan G. Sharpe (1986): Inorganic Chemistry, 2nd Ed. University of Cambridge. Oxford University Press.
2. Atkins et al. (1994): Inorganic Chemistry, 4th Ed. Oxford University Press.
3. Matthews Philip (2004): Advanced Chemistry, Low Price Edition. Cambridge University Press.
4. Wong Y.C. et al. (1998): Inorganic & Physical University General Chemistry. Manhattan Press Ltd in association with Africana-Fep Publishers.

TUTORIAL QUESTIONS

1a. State FIVE properties of IONIC compounds.

b. Write the limiting forms (or Canonical forms) of the following ions:

i. H_3O^+, ii. CO_3^{2-}, iii. NO^{3-}

c. State the most important difference between Permanent Dipole and Induced Dipole.

d. List the three factors that favours the formation of ionic compounds.

2a. State the THREE assumptions made by Bohr in his theory of atomic structure.

b. Describe vividly, the Rutherford's experiment on atomic model.

c. Draw the orbital shape of specie with the following quantum designation:

$n = 2$, $l = 1$, $m = -1$.

3a. A neutral atom of an element has two electrons with *n* = 1, eight electrons with *n* = 2, eight electrons with *n* = 3 and one electron with *n* = 4, while its mass number is 39. Deduce the following from the above information:

1. The atomic number of the element.
2. Number of electrons in the nucleus.
3. Total number of *s*-electrons.
4. Total number of *p*-electrons.
5. The group the element belongs to.

b. Calculate the pK_a of an ethanoic acid solution whose K_a is 1.85×10^{-5} $moldm^{-3}$.

c. Highlight the five statements of Dalton's atomic theory.

4a. Highlight FIVE uses of Group IIA metals.

b. Discuss the properties of Hydrogen, under the following headings:

i. Combustion with non-metals.
ii. Strong reducing action.
iii. Reaction with metals.

c. State FIVE uses of group IIIA Elements.

5a. State SEVEN uses of group IA elements.

b. State SEVEN uses of Hydrogen.

c. Differentiate between covalent and ionic bonds.

6a. Explain briefly why hydrogen gas is almost INSOLUBLE in water.

b. Calculate the pH of a buffer solution which is $0.22moldm^{-3}$ with respect to both ethanoic acid and sodium ethanoate; K_a for ethanoic acid is 1.8×10^{-5} $moldm^{-3}$

c. Draw the molecular shape and state the reasons for the different bond angles of the following compounds:

i. Ammonia, ii. Water, iii. Methane

7a. Using the Pauline Electronegativity Scale (PES), state whether the following covalent compounds are polar or not.

1. CCl_4, ii. CH_3OCH_3, iii. H_2CO, iv. CH_2Cl_2, v. C_2H_4

b. What is the maximum number of electrons in the atomic orbital that has the following quantum numbers?

i. n = 1, l = 0, m = 0
ii. n = 2, l = 1, m = 0

2. n = 3, l = 0, m = 0

c. Write the electronic configuration of the elements in (b) above.

8a. What are the values of the quantum numbers *n, l, m,* for the following orbitals occupied by an electron?

1. 7s, ii. 5p, iii. 3d, iv. 2p, v. 4f.

b. Use the quantum numbers *n, l, m,* to describe the orbital occupied by a valence electron in an atom of the following elements:

i. Nitrogen, ii. Oxygen, iii. Fluorine, iv. Lithium, v. Boron

c. Use the P.E.S. to predict the nature of bond in the following molecules:

i. O_2, ii. CH_4, iii. HF, iv. Cl_2, v. KCl

9a. State three properties of H-bonding

b. Discuss briefly five influences of bond characteristics on structure and physical properties of chemical compounds

c. Clearly draw the possible *Canonical Structures* for ammonium ion (NH^{4+})

10a. Discuss three industrial processes for the production of Hydrogen.

b. Discuss vividly, the Reducing Action of Hydrogen

c. State the two shortcomings of Rutherford's atomic model.

11a. Draw THREE geometric isomers for each of the following organic compounds:

1. Hexa-2,4-diene
2. 2,3-dimethylbut-2-ene
3. 2-chloro-3-methylpent-2-ene

b. Draw the dot-and-cross diagrams of K_2O and CaO

c. Explain briefly why group IIA elements are referred to as *alkali earth* metals.

12a. State FIVE properties of covalent compounds

b. i. State the major differences between hydrogen and London forces

ii. Using appropriate diagrams, describe how NaCl dissolves in water.

c. What mass of sodium propanoate must be added to $500cm^3$ of propanoic acid of concentration $0.20moldm^{-3}$ to give a solution of pH of 6.0? (The pKa of propanoic acid is 4.87 at 298K)

(Na = 23.0, C = 12.0, H = 1.0, O = 16.0 $gmol^{-1}$)