DEPARTMENT OF CHEMISTRY,
SCHOOL OF PHYSICAL SCIENCES
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SECOND SEMESTER EXAMINATION: 2018/2019 SESSION

COURSE: CHM 223 **UNITS: 2**
COURSE TITLE: Structures and Bonding
TIME ALLOWED: **2 hours**
INSTRUCTION: Answer any three questions.

Useful Constants: Rydberg (R_H) = 2.18 x 10^{-18}; Planck (h) = 6.628 x 10^{-34} Js;
Velocity of light (C) = 2.998 x 10^{8} ms^{-1}

Q1 a. State the Pauli Exclusion Principle. [2 Marks]
b. Define orbital and shell [4 Marks]
c. Distinguish between valence and core electron. [4 Marks]
c. Determine the Energy, Frequency and wavelength of electron transition from n=3 to n=5 in hydrogen atom. [12 Marks]

Q2a. List the quantum numbers. [4 Marks]
b. Explain the information derivable from the study of the quantum numbers. [6 Marks]
c. In tabular forms and appropriate sketches, illustrate the information in 2b in terms of symbols, digit and numeric values as applicable to:
i. series n= 3, 4 [6 Marks]
ii series l= 0, 1 [4 Marks]

Q3a. Based on the Lewis concept, illustrate the structures of:
i. HCl ii. SCN iii. NH_3 [3 Marks]
b. State two shortcomings of Lewis concept and discuss how hybridization concept overcomes this, using BeH_2 example. [4 Marks]
c. Describe the central concept of Valence Shell Electron Pair Repulsion (VSEPR) theory and then state the shapes and geometry of:
i. CH_4 ii. H_2O iii. CO_3^{2-} [8 Marks]
d. State and explain the order of bond angle in the following molecular list:
i. NH_3, H_2O and CH_4
ii. H_2Se, H_2S and H_2Te [5 Marks]

Q4 a. Explain the goal of Molecular Orbital Theory [3 Marks]
b. Give comparisons of bonding and anti-bonding molecular orbital [9 Marks]
c. State the hybridization, VSEPR symbol, bond angle and shape of the following molecules:
i. NO_2 ii. $(CH_3)_4N^+$ [8 Marks]