NATIONAL OPEN UNVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PURE & APPLIED SCIENCES
JANUARY 2018 EXAMINATION QUESTIONS

COURSE CODE: CHM307
COURSE TITLE: ATOMIC AND MOLECULAR STRUCTURE AND SYMMETRY
CREDIT: 3 UNIT
TIME ALLOWED: 3 HOURS
INSTRUCTION: ANSWER QUESTION ONE & ANY OTHER FOUR QUESTIONS.

QUESTION 1

(a). state Hund rule *(3 marks)*

(b)(i). Explain the molecular orbital theory. *(6 marks)*

(ii). Briefly explain the concept of Homo and Lumo in molecular orbital. *(4 marks)*

(c). Define Quantum Chemistry *(1 marks)*

(d). the hydrogen molecule has two electrons (e_1 and e_2) and two nuclei (A and B).

(i). Draw the coordinate in the hydrogen molecule *(2 marks)*

(ii). List the possible interactions among the species. *(6 marks)*

QUESTION 2

(a). Explain the following: (i). Bond length, (ii). Bond energy (iii). Bond dissociation energy of water.

(7 marks)

(b). An electron travels with the speed of 3X10-6ms-1, what is the minimum uncertainty in its atomic radius. Calculate same for a 0.03 kg ball travelling a speed of 25 ms-1 assuming that the uncertainty in position of the ball is equal to the wave length 600nm. *(5 marks)*

QUESTION 3

(a). Discuss the principle of rotational spectroscopy. *(6 marks)*

(b)(i). Write the classes of molecules base on their rotational behavior. *(2 marks)*

(ii). What is a Symmetric tops? *(4 marks)*

Question 4

(a). Explain the possible conditions that would cause electrons to jump from one energy level to another. *(2 marks)*

(ii). What is an electron shell. *(3 marks)*

(iv). What is a subshell. *(2 marks)*

(v). state the Pauli Exclusion Principle. *(5 marks)*

QUESTION 5

(a). analyze the shortcomings of Aufbau Principle. *(6 marks)*

(b). Define the heat capacity of a substance C. *(6 marks)*

QUESTION 6

(a). explain the valence bond theory. *(4 marks)*

(b). what is spin-spin coupling? *(4 marks)*

(c). write on JJ coupling. *(4 marks)*