

**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 (e1 and e2) 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)*