



NATIONAL OPEN UNIVERSITY 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 $3 \times 10^{-6} \text{ms}^{-1}$, what is the minimum uncertainty in its atomic radius. Calculate same for a 0.03 kg ball travelling a speed of 25ms^{-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)