NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
MARCH/APRIL 2016 EXAMINATION

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: **CHM307**
COURSE TITLE: **ATOMIC AND MOLECULAR STRUCTURE AND SYMMETRY**

TIME: **21/2 HOURS** **CREDIT UNIT: 3**
INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER FOUR QUESTIONS

1a) Discuss the treatment of molecular vibrations using Newtonian Mechanics.(8 marks)
1b) When does centrifugal distortion occurs? (6 marks)

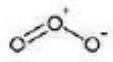
2a) Write short note on Free Electron Model (FEMO). (5 marks)
2b) Calculate the lowest absorption wavenumbers for butadiene neglecting end effects. (4 marks)
2c) Explain each of the following terms:
i) Orthogonal function
ii) Orthonormal function (5 marks)

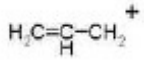
3a) Write short note on each of the below relationships:
i) The relationship between the energy of the photon and its wavelength
ii) The relationship between the momentum and the wavelength of a photon. (10 marks)

3b) Suppose $\hat{A}=d/dx$, $\hat{G}=x$ and $(x) = x^3$ do the operators commute? (4 marks)
4a) Define bonding (2 marks)
4b) Draw the molecular orbital diagram for a diatomic neon molecule. (8 marks)
4c) Calculate the bond order of Neon molecule. (4 marks)
5a) Explain the following terms and express each mathematically:
i) Rusell-Saunder´s coupling
ii) JJ coupling
iii) Nuclear coupling (3 marks each)

5b) Write briefly on each of the Quantum numbers. (5 marks)

6a) What are reactive intermediates? (3 marks)
6b) List the steps to writing resonance. (5 marks)
6c) Write the resonance structure of the structures below:

i) 

ii) 

(8 marks)

7a) Define molecular orbital and give the appropriate combinations of the atomic orbitals. (4 marks)
7b) Construct a molecular orbital diagram for the ethane molecule. (5 marks)
7c) Show the relationship between heat capacity and specific heat capacity. (5 marks)