National Open University Of Nigeria
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja
Faculty of Science

October/November 2016 Examination

Course Code: **CHM 307**
Course Title: **Atomic And Molecular Structure and Symmetry**
Credit Unit: 3
Time: 2 ½ Hours
Instruction: **Answer Question One And Any Other Four Questions. Each Question Carries 14 Marks**

1a) For the Elements given below, state the period(s) they belong to and write their electronic configuration.

(i) Silver

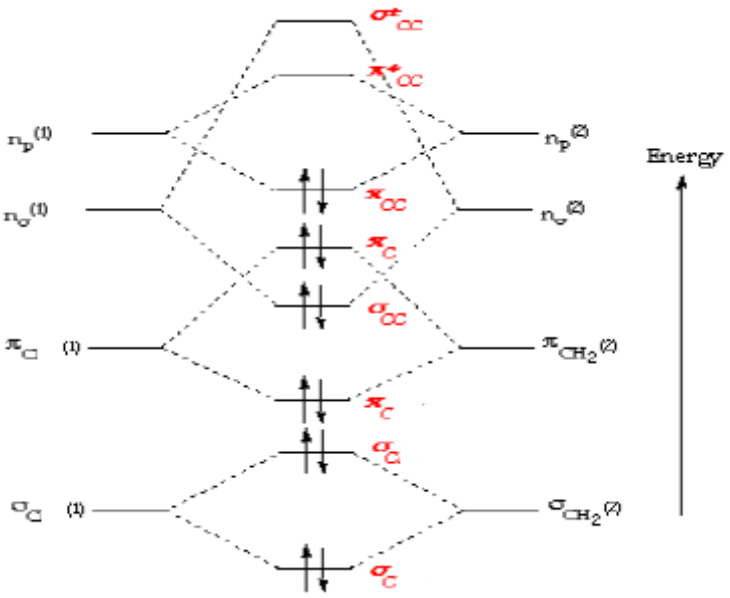
(ii) Cadmium

(iii) Platinum

(iv) Mercury

(v) Uranium

1b) Answer the following questions using the below diagram.



a. Name the diagram.
b. What type of bond does a compound represented by this diagram have?
c. Explain the relationship between this diagram and the nature of bond mentioned in (b) above.
d. Using the smallest member of the homologous series represented by this diagram above, explain HOMO and LUMO

2a) State the Modern form of the Aufbau principle.

2b) Discuss the shortcomings and naivity of the Aufbau Principle.

3a) Discuss some important consequences from Molecular Orbital Theory.

3b) Explain the relationship between molecular orbitals in polyatomic molecules and Huckel Molecular

Orbital Theory.

3c) Use Huckel Molecular Orbital Theory to explain the formation of ethane molecule.

4a) Discuss the below statement with respect to line spectra of atoms.

´´the energies of the atoms and molecules responsible for spectra lines must be discrete rather than

Continuous´´.

4b) Fill the below table with respect to the series in the spectrum of Atomic Hydrogen

Series	n2	n1	Region in electromagnetic spectrum	Wavelength(nm)
Lyman				
Balmer				
Paschen				
Brackett				
Pfund				

5a) Derive the formula of Heat Capacity using Quantum Mechanical Approach.

5b) Give two examples each of compounds in which the following chemical bonds are formed.

Chemical bonds	Example 1	Example 2
s-s		
s-p		
s-d		
p-p		
p-d		
d-d		

6) Write equation for the 3D Schrodinger wave equation and explain each of the terms.

7a) In addition to the main structure that is observed in microwave spectra due to the rotational motion of the molecule is the interaction s responsible for small changes in the spectra. Discuss this additional interactions to include the strength of such interactions.

7b) Explain the term Vibration Coordinates

7c) List the known Vibration Coordinates

7d) Choose any of the listed vibration coordinates in (c) above and explain.