NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
SEPTEMBER/OCTOBER 2015 EXAMINATION

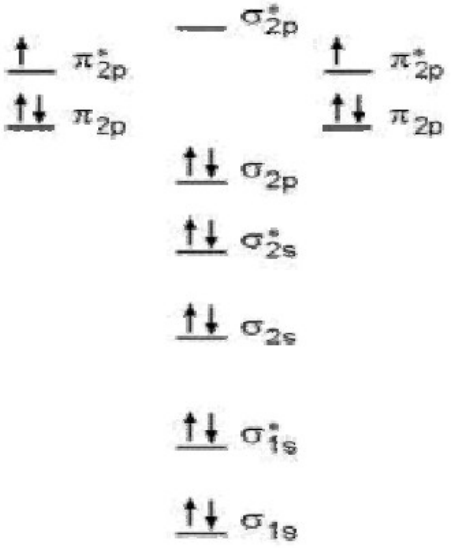
SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: CHM307

COURSE TITLE : ATOMIC AND MOLECULAR STRUCTURE AND SYMMETRY

INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER FOUR QUESTIONS
TIME : 2½hours

1a)



Given the above molecular orbital diagram, aswer the below questions:

i) Identify the molecule having this molecular orbital diagram?

ii) Calculate the bond order of this molecule.

iii) Is the molecule diamagnetic or paramagnetic? State reason for yourqdf answer.

1b) Suppose $\hat{A}$ = d/dx, $\hat{G}$ = X and (x)=x^3do the operators commute?

1c) Discuss the isotopic effect with reference to HCl.

1d) Explain the immediate consequences of symmetry on properties of molecules.

(14 MARKS)

2a) Define Electronic spectroscopy.

2b) Explain the theory of Electronic spectroscopy.

(14 MARKS)

3a) Define symmetry elements and symmetry operations.

3b) Identify all the symmetry elements in XeF4.

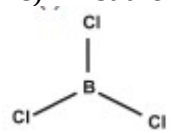
(14 MARKS)

4a) Suppose we rotate an equilateral triangle by half a turn about an axis through a vertex by turning it
over .

How many operations of this type are possible?

4b) What operations are generated by a C_5 axis?

4c) List the symmetry elements of the below molecule.



(14 MARKS)

5) Write equation for the 3D Schrodinger equation and explain each of the terms. (14 MARKS)

6a) Explain de Broglie conjecture.

6b) Explain Heisenberg's Uncertainty Principle.

6c) An electron travels with the speed of $3x10^6$ ms^{-1}. What is the minimum uncertainty in its momentum if we assume that its position is measured within 10 percent of its atomic radius. Do the
same calculation for a 0.03kg ball travelling at a speed of $25ms^{-1}$. Assume that the uncertainty in position of the ball is equal to the wavelength light of 600nm.

(14 MARKS)

7a) Briefly explain the following terms: (a) Postulates (b) Operator.

7b) Explain the usefulness of quantum mechanics.

7c) Give the postulates of quantum mechanism.

(14 MARKS)