COURSE CODE: CHM 307
COURSE TITLE: ATOMIC AND MOLECULAR STRUCTURE AND SYMMETRY
COURSE UNIT: 3
INSTRUCTION: Answer question one (1) and any other three questions
Time: 3 Hours

QUESTION 1

1 (a) List six (6) sets of symmetry operations	**(6 marks)**
(b) State Pauli's Exclusion Principle	**(2 marks)**
(c) Using the concept of bond order, why is it impossible for He_2 to exist?	**(4 marks)**
(d) Write the electronic configuration of Na^{3+}, N^{2-}, Pb^{2+}, and Al^{4+}	**(8 marks)**
(e) Draw the energy level diagram in hydrogen molecule	**(5 marks)**

QUESTION 2

a) State Hund's rule	**(5 marks)**
b) Briefly explain bond energy	**(5 marks)**
c) Explain J-J coupling	**(5 marks)**

QUESTION 3

a) What do you understand by Commutation of operators?	**(5 marks)**
bi) Briefly explain bond energy	**(4 marks)**
bii) Define bond length	**(3 marks)**
c) What is atomic spectrum?	**(3 marks)**

QUESTION 4

a) Briefly explain the effect of vibration on rotation	**(4 marks)**
b) What do you understand by Linearity of an operator?	**(3 marks)**
ci) What is the wavelength of a 100eV electron?	**(5 marks)**
cii) State the application of valence bond theory	**(3 marks)**

QUESTION 5

a) Explain bond dissociation energy	**(4 marks)**
b) Briefly explain principal quantum number	**(6 marks)**
c) Define L-S coupling	**(5 marks)**

QUESTION 6

a) What is the major limitation of Bohr's model?	**(6 marks)**
b) Calculate the wave length of electron moving at 2×10^6 m/s using the de Broglie equation	**(4 marks)**
ci) What is spin orbital?	**(2 marks)**
cii) What is the significant of hybridization in valence bond theory?	**(3 marks)**