

General and Structural Chemistry

Quiz-2

Spring Semester 2025

IIT-Hyderabad

Time: 45 min

Max Marks: 50

Q1. For the bonding between C and O with z-axis as the bond axis and resulting MOs of CO: 1σ , 2σ , 3σ , 4σ , 1π and 2π , state whether the following statements are true or false:

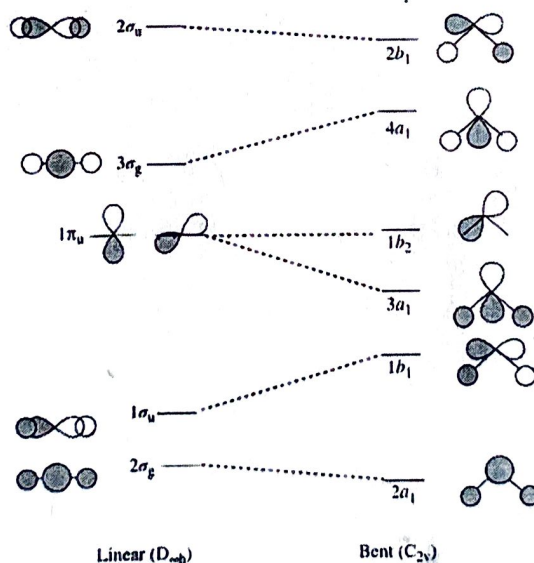
- The C p_x and p_y and O p_x and p_y atomic orbitals form 1π MO.
- The coefficients of the above atomic orbitals have equal magnitudes in the 1π MO.
- There is a decrease in energy of the 2σ MO and an increase in the energy of the 3σ MO.
- Often when CO would act as a Lewis base in the interaction between CO and a metal ion using lone pair of electrons on the O atom.
- The negative end of the dipole is on the C atom, not on more electronegative O atom.

[5×2]

Q2. Based on the Walsh diagram given below (where MO energy increases from bottom to top), predict the molecular geometries of the ground and first electronic excited state configurations of BeH_2 . Justify your answers. What are the HOMOs of the ground and first excited states, respectively?

[2,4,2]

Walsh Diagram:



Q3. A student determined the IR frequencies for CO bonds ($\nu(\text{CO})$ stretching frequencies) in the compounds, CO and $\text{Cr}(\text{CO})_6$. The $\nu(\text{CO})$ stretching frequencies are 2000 cm^{-1} and 2140 cm^{-1} . Assign the IR frequencies to the respective molecules. Justify your assignment. [5]

Q7. Fill in the blanks with correct words/phrases:

[5×2]

- (i) A metal is less malleable than metal.
- (ii) Metals with a of electrons are more likely to adopt the fcc.
- (iii) The is better suited to metals with few valence electrons.
- (iv) In general, atomic orbitals will generate n molecular orbitals with possible nodes.
- (v) Sodium metal crystallizes in the structure and there are only valence electrons per unit cell.

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