General and Structural Chemistry

Quiz-2

Spring Semester 2025

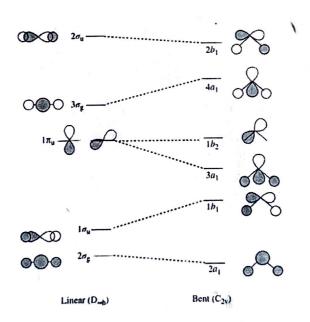
IIIT-Hyderabad

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:

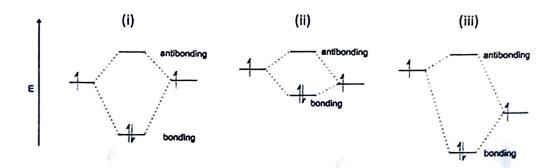
- (i) The C p_x and p_y and O p_x and p_y atomic orbitals form 1π MO.
- (ii) The coefficients of the above atomic orbitals have equal magnitudes in the 1π MO.
- (iii) There is a decrease in energy of the 2σ MO and an increase in the energy of the 3σ MO.
- (iv) Often when CO would act as a Lewis base in the interaction between CO and a metal ion using lone pair of electrons on the O atom.
- (v) 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 BeH₂. Justify your answers. What are the HOMOs of the ground and first excited states, respectively? [2,4,2]

Walsh Diagram:

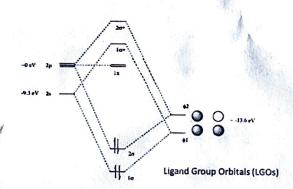


Q3. A student determined the IR frequencies for CO bonds (ν (CO) stretching frequencies) in the compounds, CO and Cr(CO)₆. The ν (CO) stretching frequencies are 2000 cm⁻¹ and 2140 cm⁻¹. Assign the IR frequencies to the respective molecules. Justify your assignment. [5]

Q4. The following schematic MO diagrams (i, ii, & iii) depict the C-C, C-Cl, and C-Br bond formations. Match each diagram to the correct bond formation. Explain. [3×2]

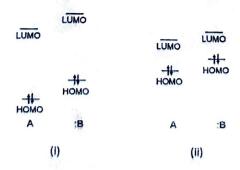


Q5. Below is shown an MO diagram for a compound. Explain whether the following compound will behave as a good Lewis acid or a good Lewis base. [3]



Q6. Two sets (i & ii) of Lewis acids-bases are shown below. Identify the (relatively) hard and soft acids and bases. Justify your choice.

[4×2]



Q/. riii i	n 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 structu valence electrons per unit cell.	re and there are only