Name _____ Test 2 (10/23)

CHEM 0211 (Adv. Inorganic) Fall 2012

1. (12 pts.) Describe what each of the following symmetry operations are.

a. a C_2 operation

b. a σ_v operation

c. an *i* operation

1. _____

2. _____

3. _____

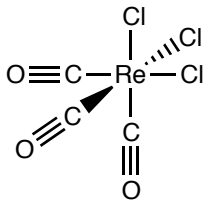
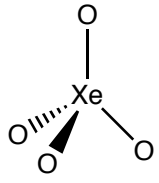
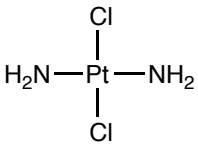
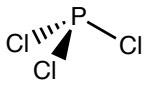
4. _____

5. _____

6. _____

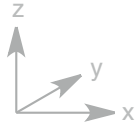
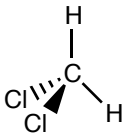
7. _____

2. (16 pts.) Determine the point group for each of the following molecules. Wedge and dashed 3D representations have been provided.

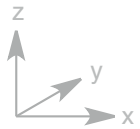
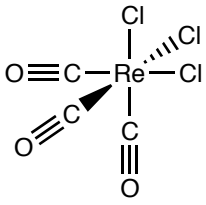
a. 	b. 
d. 	d. 

3. (12 pts.) Perform the indicated operations on the following molecules, and draw a wedge and

a. Perform a C_3 on the z axis

b. Perform a reflection through a yz mirror plane

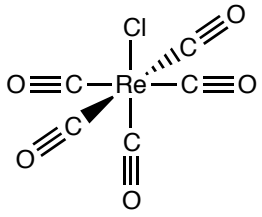



dash representation for the resulting view.

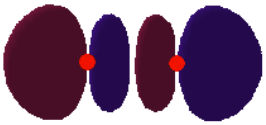
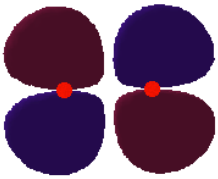
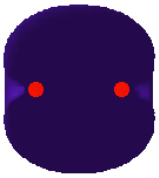
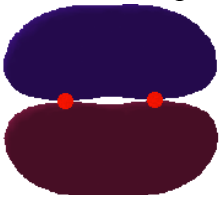
4. (10 pts.) Determine the irreducible representation for the following reducible representation.

C_{4v}	E	2 C_4	C_2	2 σ_v	2 σ_d		
A_1	1	1	1	1	1	z	$x^2 + y^2$, z^2
A_2	1	1	1	-1	-1	R_z	
B_1	1	-1	1	1	-1		$x^2 - y^2$
B_2	1	-1	1	-1	1		xy
E	2	0	-2	0	0	(x, y), (R_x, R_y)	(xz, yz)
Γ	5	-1	1	-1	3		

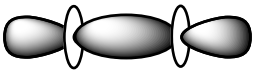
5. (10 pt.) Determine the number of CO stretching bands that you would expect to see in the IR spectrum of $Re(CO)_5Cl$. Rhenium pentacarbonyl chloride is in the C_{4v} point group.



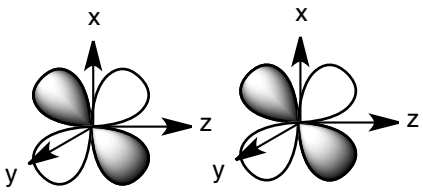
6. a. (3 pts. each) Determine whether the following orbitals would be bonding or antibonding.
b. (2 pts. each) Determine whether the orbitals are gerade or ungerade

i. MO made from two p_z orbitals 	ii. MO made from two p_x orbitals 
iii. MO made from two s orbitals 	iv. MO made from two p_x orbitals 

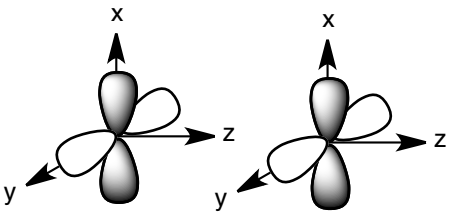
7. The following MO cartoon represents an orbital formed from the interaction of two d_{z2} orbitals.



a. (8 pts.) Explain why this is a bonding orbital

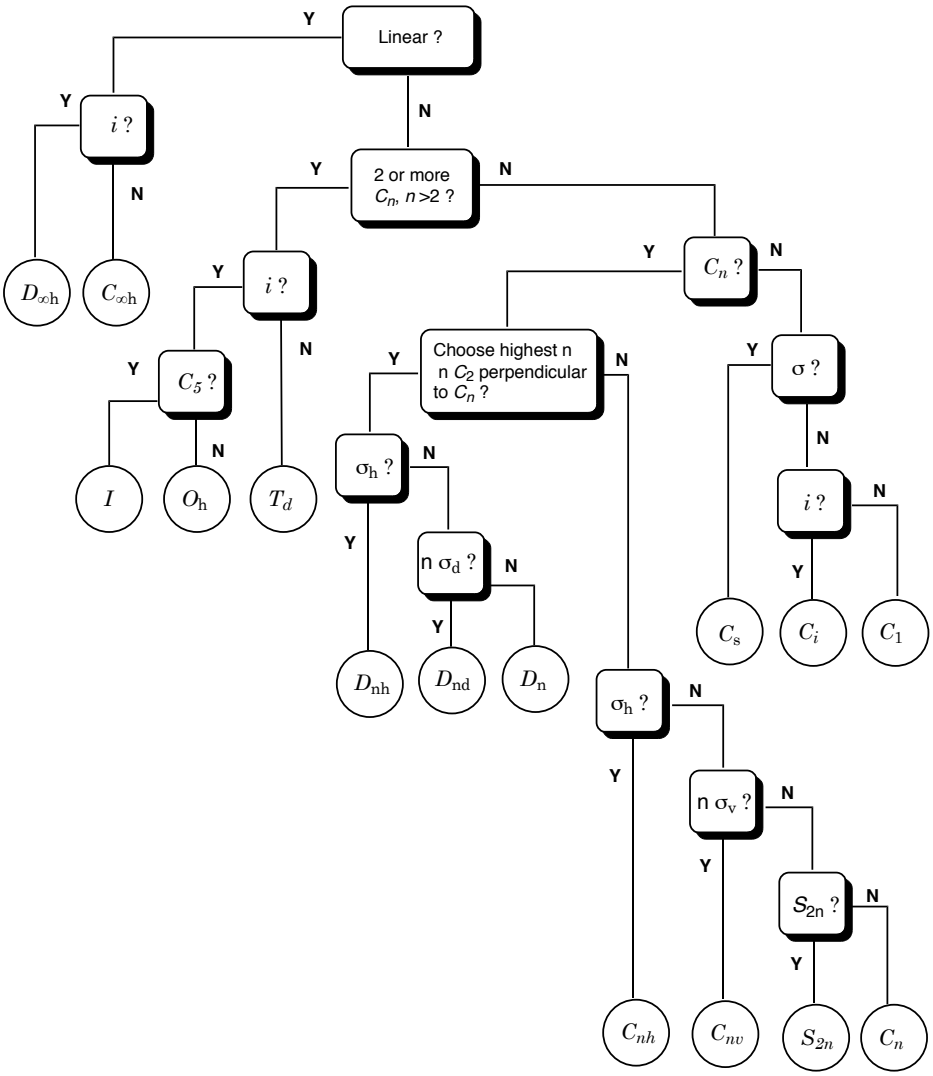
b. 

(4 pts.) A cartoon representation of two d_{xz} orbitals is drawn to the left. The MO's that form from these orbitals would have what type of symmetry (σ, π, etc.)

c. 

(4 pts.) A cartoon representation of two d_{x2-y2} orbitals is drawn to the left. The MO's that form from these orbitals would have what type of symmetry (σ, π, etc.)

Point Group Assignment Tree



$$\left(\begin{array}{c}\text{number of irreducible}\\ \text{representations of a given}\\ \text{type needed}\end{array}\right) = \frac{1}{\text{order}} \Sigma_{\text{classes}} \left(\begin{array}{c}\#\text{ operations}\\ \text{in class}\end{array}\right)\left(\begin{array}{c}\chi \text{ of the irreducible}\\ \text{representation}\end{array}\right)\left(\begin{array}{c}\chi \text{ of the reducible}\\ \text{representation}\end{array}\right)$$