Name ____________________ Test 2 (11/4)
CHEM 0211 (Adv. Inorganic) Fall 2015

1. ________
2. ________
3. ________
4. ________
5. ________

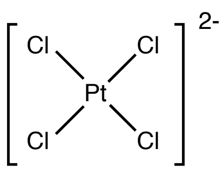
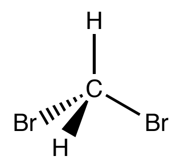
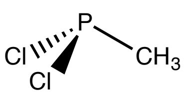
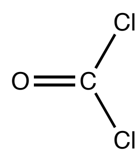
1. (12 pts.) Describe what each of the following symmetry operations are.

 a. a C_3 operation

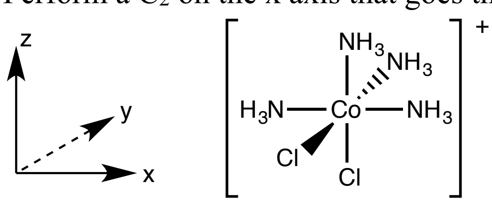
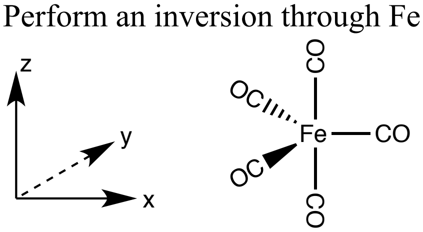
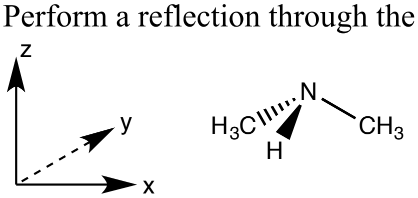
 b. a σ_v operation

 c. an S_4 operation

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 3D representation, using wedge and dash notation where appropriate, for the resulting view.

a. Perform a C_2 on the x axis that goes through the Co atom 
b. Perform an inversion through Fe atom 
c. Perform a reflection through the xz plane that contains the nitrogen atom 

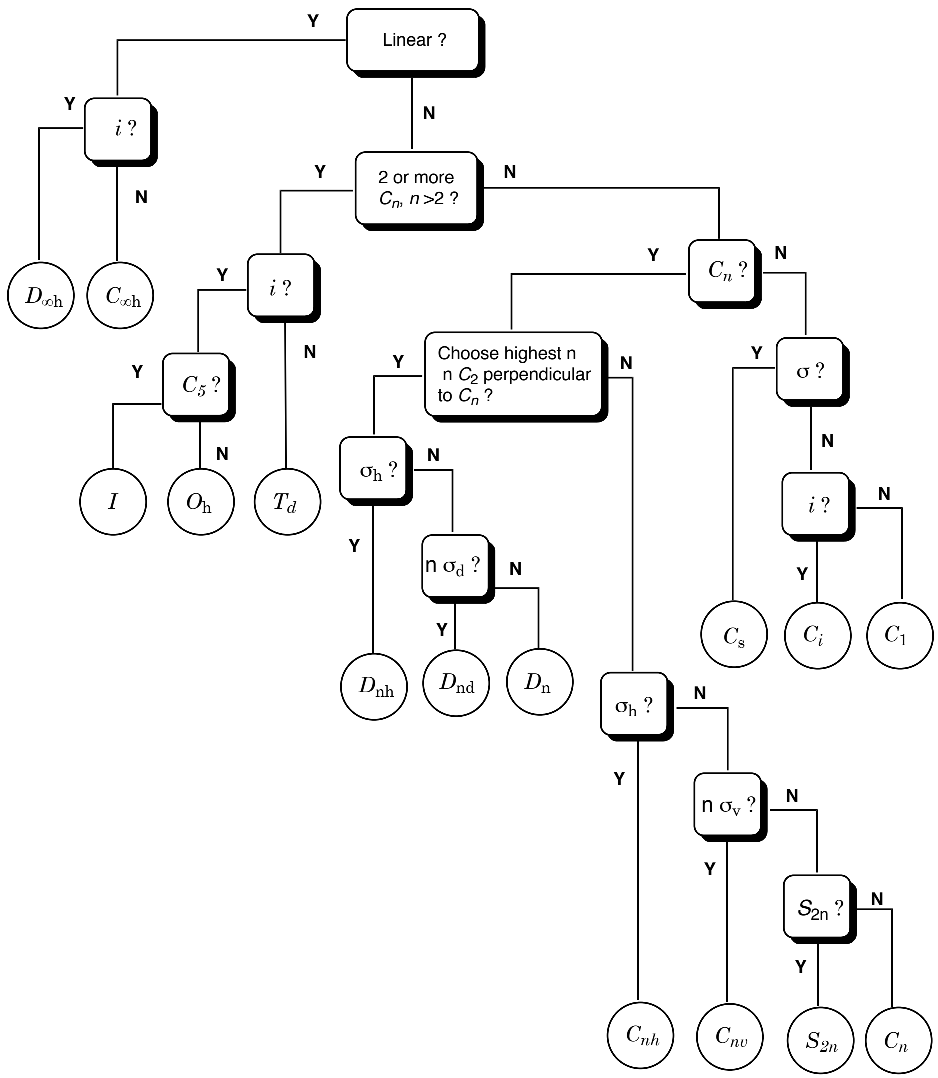
4. (10 pts.) Determine the irreducible representation for the reducible representation listed at the bottom of the following character table.

T_d	E	8 C_3	3 C_2	6 S_4	6 σ_d		
A_1	1	1	1	1	1		$x^2 + y^2 + z^2$
A_2	1	1	1	-1	-1		
E	2	-1	2	0	0		$2z^2 - x^2 - y^2$, $x^2 - y^2$
T_1	3	0	-1	1	-1	(R_x, R_y, R_z)	
T_2	3	0	-1	-1	1	(x, y, z)	(xy, xz, yz)
Γ	6	3	2	-2	0		

5. (10 pt.) a. Determine the reducible representation for the C–Cl stretching vibrations for CH_2Cl_2.
b. Determine the irreducible representations for the C–Cl stretching vibrations.
c. Determine the number of C–Cl stretching bands that you would expect to see in the IR spectrum of CH_2Cl_2. The molecule is in the C_{2v} point group.

C_{2v}	E	C_2	σ_v(xz)	σ_v(yz)		
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	-1	-1	R_z	xy
B_1	1	-1	1	-1	x, R_y	xz
B_2	1	-1	-1	1	y, R_x	yz

Point Group Assignment Tree



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