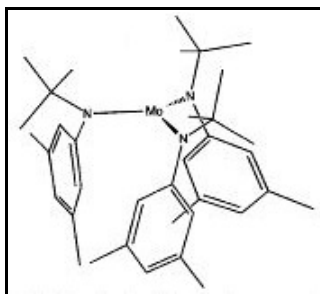
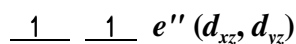
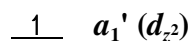
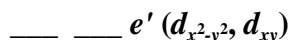


Chem 370 - Spring, 2019
Fifteen Minute Quiz No. 8

(5 points) Three coordinated complexes (CN3) are not common, but examples can be found among all first-row and some second-row transition metals. One example that has been characterized¹ is the molybdenum(III) complex (d^3) Mo(NRAr)₃, where R = C(CD₃)₂CH₃ and Ar = 3,5-C₆H₃(CH₃)₂. As the structure below shows, the coordination about the central atom is trigonal planar (D_{3h}).



- a. (4 points) With the aid of the D_{3h} character table on the last page, show the crystal field splitting and relative ordering of energies of the d orbitals of Mo³⁺ in a trigonal planar CN3 field. Label each level with both the Mulliken symbol (lower case) and specific d orbital(s). Show the filling of the three electrons for Mo³⁺. [Hints: Those orbitals entirely or partially in the xy plane will experience greater perturbation from the ligand field than those that are not in that plane. All CN3 complexes are expected to be high-spin.]



- b. (1 points) What is the value of the spin-only magnetic moment in Bohr magnetons for this complex?

$$\mu = \sqrt{3(3+2)} \text{ B.M.} = 3.87 \text{ B.M.}$$

¹C. E. Laplaza and C. C. Cummins, *Science*, 268, 861 (1995).

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1'	1	1	1	1	1	1		$x^2 + y^2, z^2$
A_2'	1	1	-1	1	1	-1	R_z	
E'	2	-1	0	2	-1	0	(x, y)	$(x^2 - y^2, xy)$
A_1''	1	1	1	-1	-1	-1		
A_2''	1	1	-1	-1	-1	1	z	
E''	2	-1	0	-2	1	0	(R_x, R_y)	(xz, yz)