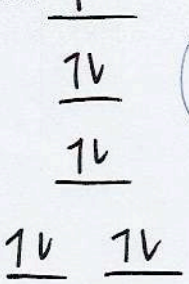
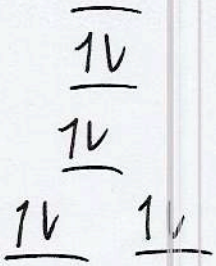
1. The N-H bonds present in tetraphenylporphyrin leads to a single C_2 axis, a vertical reflection axis in the plane of the molecule, and no horizontal reflection axes. This is a relatively low degree of rotational symmetry that is forced by the presence of the 2 N-H bonds on opposite sides of the molecule. When these N-H bonds are removed, the degree of rotational symmetry is increased because the metal-N bonds in the metalloporphyrin (Ni-TPP) are more highly symmetrical. This induces a new axis of higher symmetry, a C_4 axis perpendicularly penetrating the plane of the molecule. This new C_4 axis will cause a change in point group.
2. To get this molecule, replace benzaldehyde with 4-methoxy benzaldehyde.
3. Cu-TPP



-1 Label the d-orbitals

Ni-TPP



4. Fluorescence is the emission of absorbed light at a different wavelength, especially the absorption of a high energy photon and the emission of that photon in a lower energy state. The $\pi \rightarrow \pi^*$ transition accounts for the fluorescence of TPP. When the metal binds, the $d_\pi \rightarrow \pi^*$ backbonding raises the ΔE, which causes a loss or reduction in the amount of emission encompassing fluorescence. The reason that Ni-TPP causes loss of fluorescence while Zn-TPP does not rests on the fact that there is less $d_\pi \rightarrow \pi^*$ backbonding at play in the zinc complex, preventing the increase in ΔE which causes loss of fluorescence.[1] Because of this, the Zn(TPP) complex fluoresces just as the TPP molecule does.

References:

1) Marsh, Diane F. and Mink, Larry M., *J. Chem. Ed.*, 1996, *73*, 1188.
2) Falvo, RaeAnne E. and Mink, Larry M., *J. Chem. Ed.*, 1999, *76*, 237.
3) Mink, Larry M. and Saucedo, Laura. *J. Chem. Ed.*, 2005, *82*, 790.