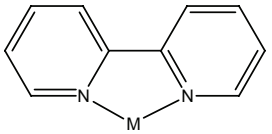
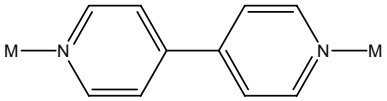
Chapter 14

Inorganic Chemistry

1. 2,2'- and 4,4'-bipyridine are bidentate ligands (see below). Can each be chelating, bridging or both?



2,2'-bipyridine is bidentate and a chelating ligand



4,4'-bipyridine is a bridging ligand

2,2'-bipyridine is a bidentate ligand because the orientation of the two nitrogen lone pairs can accommodate only one metal. 4,4'-bipyridine is a bridging ligand because the two nitrogen lone pairs require two metal atoms.

3. How many d electrons does Co^{2+} contain? How many unpaired electrons do low spin and high spin Co^{2+} contain in an octahedral field? Co^{2+} is d^7

weak field
high spin
$S = 3(^1/_2) = {}^3/_2$

strong field
low spin
$S = {}^1/_2$

5. What is the role of the magnesium ion in photosynthesis?

The magnesium ion alters the electronic structure of the porphyrin and is therefore responsible for chlorophyll's color. Consequently, it dictates the energy of the photons that are absorbed.

7. Discuss the coordination chemistry of carbon monoxide poisoning.

CO is a strong Lewis base and binds irreversibly to the iron in hemoglobin, displacing the O_2. Hemoglobin can no longer function to transport O_2 when the iron is bound to CO.

9. Explain how a partial reduction of a band results in conductivity.

Conduction can occur only if there are unfilled orbitals at an energy that accessible by the electrons. If the band is full and the band gap is large, the material will be an insulator. However, if some electrons are placed into the empty band by a partial reduction, the material will conduct because there will be electrons and unfilled orbitals in the same band.