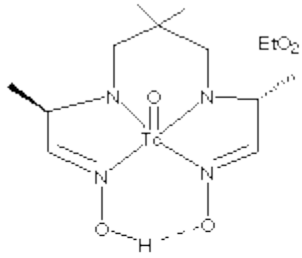
Coordination Chemistry

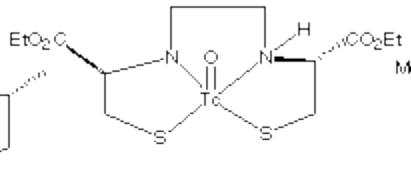
Practice Problems

http://web.tock.com/kalee/chem32/coor/

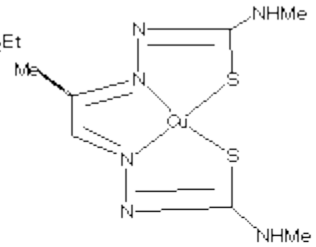
1.* (1997 F 4) Certain coordination compounds are used in clinical medicine as heart and brain imaging agents. A selection of these is shown below (from "Chemistry in Britain", October 1994, P. 820).



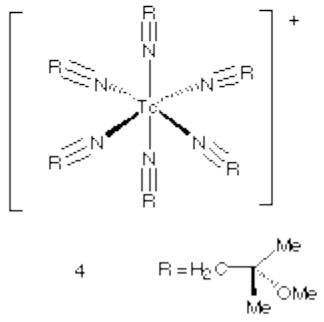
1 Tc-HMPAO



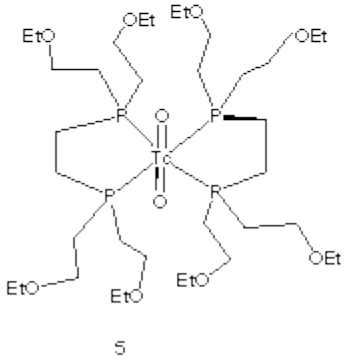
2



3 Cu-PTSM



4



5

A. Indicate which compounds are chiral. (assume the two oxo groups in (5) are trans.). Write the compound numbers for any chiral compounds you find in Figure 2.

B. Compound 2 enters the brain by diffusing through the brain blood barrier; this substance is trapped because it is acted on in the brain by an esterase. A stereoisomer of 2 is not trapped in the brain. Propose a plausible explanation of this fact.

C. What is the oxidation state of copper in compound 3? Predict the coordination geometry, and d-electron configuration for 3.

D. What is the oxidation state, d-electron configuration, and number of unpaired electrons in compound 4?

2.* (1997 2 2) A. Using any bidentate ("chelating") ligand of your choice, draw a structural formula for a first-row coordination complex which is both chrial and has three unpaired electrons. Also indicate the oxidation state, coordination number, and d electron count of the metal in your complex. Your structure should illustrate the chiral nature of this compound.

B. Identify the 3d metal in the following diamagnetic complex anion: $M(CN)_6^{4-}$. What is the oxidation state and d-electron count for your metal?

3.* (1997 2 3) Suppose you prepare a complex from propylenediamine, pn ($H_2NCH(CH_3)CH_2NH_2$) and rhodium: $Rh(pn)_3(ClO_4)_3$.

A. What is the oxidation state of Rh and the d-electron count for this complex?

B. Discuss the expected magnetic properties of this compound.

4.* (1996 F 1) What's the maximum number of unpaired electrons any transition metal complex can have?

A. Illustrate this for a metal with oxidation state 2+.

B. What other condition must be satisfied?

5.* (1996 F 2) Platinum II typically forms diamagnetic, square-planar complexes. Attempts to make octahedral Pt(II) complexes, even with a rigid multicyclic ligand which would force six nitrogens to bind in an octahedral fashion to Pt(II) have not succeeded even though such "sepulchrate" complexes of Co(III) are well known and are very stable. Use ligand field diagrams to explain the reluctance of platinum (II) to form octahedral complexes.