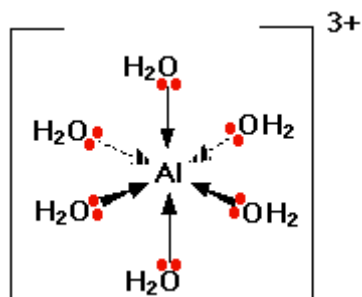# Chemguide – questions

COMPLEX IONS - INTRODUCTION

1. The diagram shows the structure of a complex ion, $Al(H_2O)_6{}^{3+}$.

a) Use the diagram to explain what is meant by the term *ligands*.

b) What is the essential feature of a molecule or ion which can serve as a ligand?

c) What sort of bonding is there between the ligand and the metal ion?

d) What is the coordination number of the aluminium in this ion?

e) Explain what the symbols for the various bonds mean.

f) Write the electronic structure for the aluminium atom in s, p, d notation.

g) Write the electronic structure for an Al^{3+} ion in s, p, d notation.

h) Explain how the aluminium ion can become attached to six water molecules.

2. Nickel forms a complex $Ni(NH_3)_6{}^{2+}$. Nickel has the electronic structure $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$. Assuming that there is no rearrangement of the 3d electrons when the ammonia molecules attach to the Ni^{2+} ion, explain the bonding in the complex.

3. a) The molecule 1,2-diaminoethane is a bidentate ligand. Draw its structure.

b) Explain what is meant by a bidentate ligand, and explain why 1,2-diaminoethane can act as a bidentate ligand.

c) Write the formula of the complex ion that this forms with Cr^{3+} ions.

d) Name and draw the structure of another bidentate ligand mentioned on the Chemguide page, making it clear in your diagram the features which enable it to act as a bidentate ligand.

4. The diagram below shows the very simplified structure of haemoglobin.
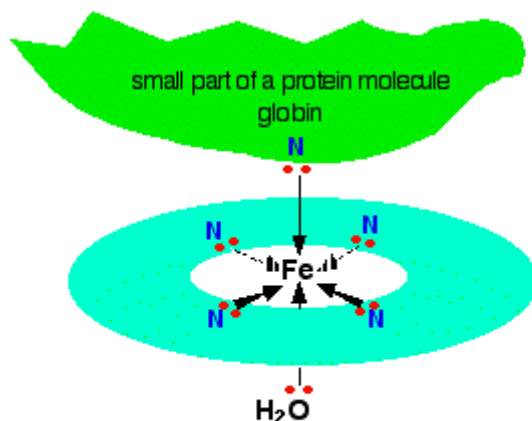
a) What is the name of the quadridentate ligand in the centre of the diagram?

b) Explain how haemoglobin is involved in the transport of oxygen around the body.

c) How does carbon monoxide disrupt this?

5. The diagram shows the complex formed between copper(II) ions and EDTA^{4-} ions. EDTA^{4-} is a hexadentate ligand.

the [Cu(EDTA)]$^{2-}$ ion
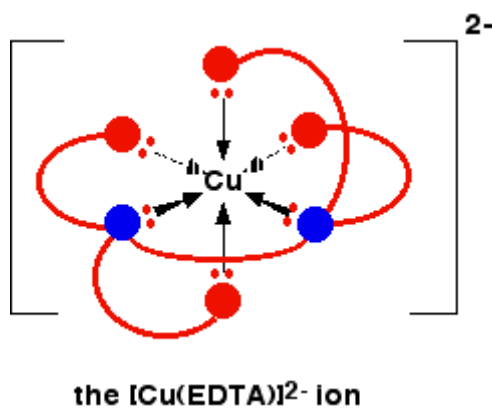
EDTA forms similar complexes with lots of other metals. Writing the EDTA simply as EDTA, what would be the formula of the complex between EDTA^{4-} and

a) Cr^{3+} ions;

b) Ag^+ ions?