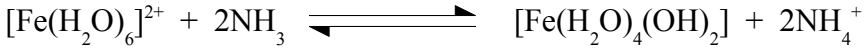
COMPLEX IONS: REACTIONS OF HEXAAQUA IONS WITH AMMONIA SOLUTION

1. If you add ammonia solution to iron(II) sulphate solution, the reaction is:



$$[Fe(H_2O)_6]^{2+} + 2NH_3 \rightleftharpoons [Fe(H_2O)_4(OH)_2] + 2NH_4^+$$

a) Describe what you would see if you did this reaction.

b) Explain carefully what is happening during the reaction.

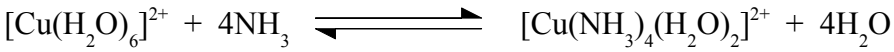
c) Write the equivalent equation for the reaction between iron(III) chloride solution and ammonia solution.

2. If you add ammonia solution to copper(II) sulphate solution, you first get a pale blue precipitate, but this dissolves in an excess of ammonia to give a very deep blue solution.

a) Write the equation to show the formation of the precipitate.

b) What is the ammonia acting as in this reaction?

c) When the ammonia is added to excess to give the deep blue solution, the overall equation for this reaction is usually written as:



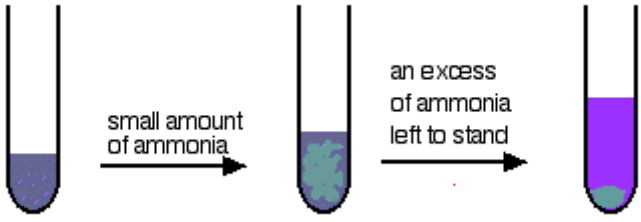
$$[Cu(H_2O)_6]^{2+} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4(H_2O)_2]^{2+} + 4H_2O$$

What is the ammonia acting as in this reaction?

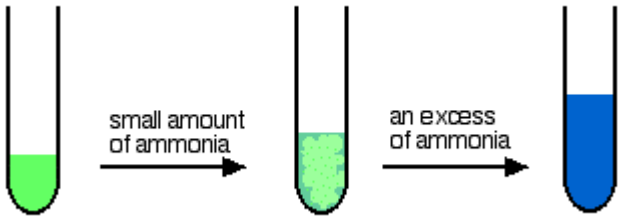
d) This equation is a simplification, because it isn't showing the formation of the product from the pale blue precipitate, but from the unreacted hexaaquacopper(II) ion. Use the equation you have written in 2(a) together with the equation in 2(c) to explain why the precipitate dissolves in the excess ammonia solution.

3. Identify all the metal complexes present in the following reactions.

a)



b)



c) A colourless solution giving a white precipitate with a small amount of ammonia solution, dissolving in excess ammonia solution to give a colourless solution again.