COMPLEX IONS: LIGAND EXCHANGE REACTIONS

1. Concentrated hydrochloric acid is added to two different solutions containing hexaaquacopper(II) ions and hexaaquacobalt(II) ions.

   a) Write the formula for each of the original ions.

   b) Write the formula for each of the ions when ligand exchange is complete.

   c) Describe the colour change in each reaction.

   d) Write the overall equation for each reaction, and use it to describe and explain what would happen if you diluted each solution with water.

2. This question is about replacing water molecules in a complex ion by ammonia. In each case, use the descriptions to identify the original complex ion and the one formed when the exchange is complete. You simply need to write the formulae for the complex ions before and after reaction.

   a) A pink solution which gives a pale brown solution with an excess of ammonia solution.

   b) A pale blue solution which gives a very dark blue solution with an excess of ammonia solution.

   c) A violet-blue-grey solution which gives a purple solution with an excess of ammonia solution.

3. Potassium thiocyanate solution is used as a very sensitive test for the presence of iron(III) ions in solution. Explain the chemistry of the test.

4. Chrome alum is a double salt of chromium(III) sulphate and potassium sulphate. It forms deep purple crystals with a formula $Cr_2(SO_4)_3,K_2SO_4,24H_2O$.

   When it dissolves in water, it behaves as a simple mixture of chromium(III) sulphate and potassium sulphate, and is often used as a source of chromium(III) ions because it is easy to dissolve in water.

   It dissolves to give a purplish solution which changes colour on gentle warming.

   a) State what colour it changes to.

   b) Explain the change, giving the formulae of any complex ions you talk about.