Preparation of a transition metal complex Transcript

Transition elements are found in the d block of the Periodic Table, between groups 2 and 13.

Some transition elements can form natural or man-made complexes with a variety of ligands.

The haem group at the centre of the protein molecule haemoglobin, found in red blood cells, is an example of a natural transition metal complex.

In this experiment, the cobalt transition metal complex, pentaamminechlorocobalt(III) chloride will be prepared and the percentage yield calculated.

First, a weighing boat is added to the balance and the tare button is pressed.

Approximately, 5 g of ammonium chloride is weighed out and is transferred carefully to the conical flask.

Then, concentrated ammonia is added to the conical flask and the mixture is swirled.

Next, approximately 10 g of cobalt(II) chloride hexahydrate is measured out and split into four portions.

The first portion is then added to the conical flask, and the contents of the flask are continually swirled until the cobalt chloride has reacted.

The process is repeated with the other three portions of cobalt(II) chloride hexahydrate.

A brown slurry solution will form.

Now, hydrogen peroxide is added to the conical flask slowly. The reaction is exothermic and effervesces. More hydrogen peroxide is added with swirling until the solution turns a deep red colour.

The flask is allowed to cool to room temperature, and then concentrated hydrochloric acid is added to the solution, slowly.

White gas will be seen sitting on top of the solution.

When all the acid has been added, a magnetic flea is put into the conical flask and the solution is heated gently and stirred.

A purple precipitate will eventually form. When the product settles in the flask a deep blue supernatant liquid is observed. Whilst the conical flask is cooling, the equipment for vacuum filtration is set-up.

Two pieces of filter paper are added to the Buchner funnel.

To hold this in place a small amount of distilled water is washed through the funnel.

The contents of the flask are swirled and poured into the funnel.

The conical flask is washed out with several portions of water, which is poured through the funnel. This ensures that all the product is collected.

Finally, the product is washed with propanone.

Once dry, the vacuum is turned off and the product is carefully transferred to a watch glass.

The product is then left to air dry for 5 minutes. The product and filter papers are now placed on the balance and the masses recorded. From these values, the actual mass of product collected can be calculated.

The theoretical yield of the product is found using the chemical equation for the reaction.

When based on 10.09 g of starting material, the theoretical yield of the product is 10.62 g.

The actual mass of product collected was 8.99 g, which gives a percentage yield of 85%.

Man-made transition metal complexes have a variety of uses such as pigments in paints and as anti-cancer drugs, such as cisplatin, which acts by binding to sections of the DNA in cancer cells, preventing cell division.