Louise King 25th March, 2002

Displacement Reactions of Metals

Task

Investigate the effect of having pieces of metal in contact with solutions of other metal salts.

Required Apparatus

3 Copper Strips
3 Zinc Strips
1 small cup of Silver Nitrate
1 small cup of Copper Sulphate
1 small cup of Lead '2' Nitrate
6 small test tubes
1 test tube rack
3 small pipettes

Safety

For this experiment you have to wear a white lab jacket or apron, protective glasses and a pair of gloves. As we are dealing with potentially dangerous gases so precautions have to be taken. In this experiment it is essential to wear protective gloves as if any acid falls onto your hand it could cause permanent damage. When we put the various acids into the test tubes we need to use pipettes so that no acid is spilt on either our selves or the table. After using the acids do not pour them down the sink as this is both dangerous and you would be wasting the acids which could be reused (as some of the acids, like Silver Nitrate are expensive). Finally, it is essential to place the test tubes upright in a test tube rack so there is no chance of the acids spilling.

Method

Firstly gather up all the apparatus required (as shown above). Put all the copper and zinc strips into separate test tubes. Fill around 1/6 of two test tubes (one with a copper strip and another with a zinc strip) with Silver Nitrate. Then repeat this with the other solutions; Copper Sulphate and Lead '2' Nitrate. A simplified version of this is shown below:

Now leave the test tubes for between 20-40 minutes. By now on some of the strips, small crystals should have formed and this will be noted in our table of results. After the experiment is over we need to pour the contents of our test tubes into different beakers and not down the lab sinks. The last thing we need to do is to put all our equipment away.

Results

Below is a table showing my results. I have included the solution, metal and then a comment of what I saw:

Solution / Metal	Silver Nitrate	Copper Sulphate	Lead '2' Nitrate
Copper	Grey Crystals (of silver) formed on the copper strip.	No Result as both the solution and metal are Copper.	No Reaction
Zinc	Black Crystals (of silver) formed, however the heavier pieces fell off and lay at the bottom of the test tube.	Black Crystals (of copper) formed on the zinc strip.	Dark Grey Crystals (of lead) formed on the zinc strip, however some of the heavier lead crystals dropped to the test tube bottom.

Conclusion

A Chemical reaction takes place ("Displacement reaction"), when the metal added is higher up in the activity series than the metal present in the salt solution. When this happens we saw the crystals formed. For example when using the zinc strip and Silver Nitrate many black crystals of silver were produced. The more reactive metal, zinc displaced the less reactive metal silver, from its compounds. However, when we mixed the copper strip with the Lead '2' Nitrate, no chemical reaction occurred. This is because the copper is not high enough in the activity series to replace the lead so no reaction takes place.

When we dipped the zinc strip into the Copper Sulphate, the zinc displaces the copper. The previously blue copper solution looses its colour in the reaction and the zinc gets coated in a dark red-brown copper metal.

To conclude: with a more reactive metal (one higher up in the activity series) will always displace a less reactive metal (one lower down in the activity series) from its compounds. The more reactive metal takes away the non-metal from the less reactive metal. Displacement reactions can be very useful in our daily lives as they are frequently used to produce electricity in batteries.