The extraction of copper: a microscale version

Copper can be extracted from copper oxide using hydrogen. The risk of an explosion makes this experiment quite hazardous on a large scale, but when approached with care it can be done safely on a microscale level.

Equipment

- 1 comboplate®
- 2 cm³ syringe
- 1 x lid number 1
- 1 x lid number 2
- 2 short lengths silicone tubing
- 1 x 10 cm piece of glass tubing
- 1 microburner filled with ethanol (Highly flammable)
- Copper oxide (Harmful)
- 3 cm magnesium ribbon (Highly flammable)
- Approx 2 cm³ hydrochloric acid 2 mol/dm³ (Irritant)
- Eye protection.

Health and safety

Wear eye protection.

Ethanol is highly flammable – keep the microburner upright and blow it out when you have finished.

Take care when fixing the silicone tubing to the glass tube – the glass could break and cut your hand. To minimise the risk, hold the glass tube near to the end where you are attaching the silicone tube. If in doubt, ask your teacher.
What to do

- Attach a piece of silicone tubing to each of the lids.
- Half fill well F1 with tap water and attach lid number 2 to it.
- Gently coil the magnesium ribbon to fit into well F6 and attach lid number 1.
- Fill well E6 with hydrochloric acid.
- Dip the end of the glass tubing into the pot of copper oxide and collect some of the powder in the end of the tube. Gently tap the tube to get the copper oxide more or less into the middle of the tube.
- Fix each end of the glass tube to the silicone tubing attached to the lids (see the diagram for what the set-up should look like). Hold the glass tube near the end you are attaching when you do this.
- Carefully fill the syringe with acid from well E6, attach the syringe to the lid on well F6 and add a drop or two of the acid to the magnesium so that it starts fizzing. You will be able to see if the hydrogen produced by this reaction is flowing through the system because it will produce bubbles in the water in well F1. You need to add the acid in drops throughout the experiment to keep a slow but steady stream of bubbles.
- Light the microburner and begin to heat the copper oxide in the tube. Keep heating for a minute or two and watch for changes occurring in the tube. When there are no more changes, stop heating, wait for a moment and then try and light the gas coming out of well F1.
- Blow out the microburner and detach the lids from the comboplate®.
- When the glass tube has cooled, remove it from the other apparatus and tap the end gently on a piece of rough paper to extract the product.

Questions

1. Record what you observed in the tube throughout the experiment.

2. Two products are made in this reaction – what are they?

3. What are the reactants?
   (Hint: You tested for one of them with the microburner at the very end of the experiment.)

4. Write a word and a symbol equation for the reaction.
5. What type of reaction is this?

6. Which is more reactive – hydrogen or copper?

7. Could you use hydrogen to extract the metals below from their ores?
   You may need a copy of the reactivity series to answer this question.
   a. Sodium
   b. Magnesium
   c. Lead