

Reduction of an Ore



Introduction

Obtain copper metal from its copper(II) oxide ore by reduction with charcoal.

Concepts

- Redox reactions
- History of chemistry

Materials

Copper(II) oxide, CuO, 2 g	Crucible tongs
Charcoal, powder, 2 g	Ring stand and ring
Bunsen burner	Stirring rod
Crucible and cover	Triangle, pipe stem

Safety Precautions

Allow the crucible to cool before handling it or observing the copper product. Powdered charcoal is a flammable solid. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Set up the Bunsen burner, ringstand, ring, and pipe stem triangle.
2. Mix 2 g of copper(II) oxide with 2 g of powdered charcoal in the crucible.
3. Cover the crucible and set it in the pipe stem triangle.
4. Strongly heat the crucible in the flame of the Bunsen burner for 10 minutes.
5. Allow the crucible to cool slightly. Remove the crucible cover using tongs. Observe the bright copper powder now mixed with the black material.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Dispose of the solid material in the trash according to Flinn Suggested Disposal Method #26a.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

- Evidence, models, and explanation
- Constancy, change, and measurement

Content Standards: Grades 5–8

- Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

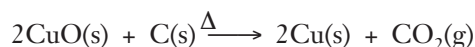
- Content Standard B: Physical Science, structure and properties of matter, chemical reactions

Tips

- A molar excess of charcoal must be used for the reaction to occur. The amounts given in this demonstration take this into account.
- Crucibles have a tendency to crack if heated or cooled too quickly. For this reason, begin heating slowly at first, then heat more strongly. When cooling the crucible, allow the crucible and cover to cool to room temperature before setting it on a countertop.

Discussion

Carbon, in the form of charcoal, is an important reducing agent. It can be used to remove the oxygen from metallic oxides. To remove the oxygen from copper(II) oxide, CuO, a mixture of charcoal and copper(II) oxide is simply heated in a crucible. The products are pure copper metal and carbon dioxide gas.



Reference

Bilash, B.; Gross, G.; Koob, J. *A Demo A Day™, Volume 2—Another Year of Chemical Demonstrations*; Flinn Scientific, Inc.: Batavia, IL, 1998; p 247.

Materials for *Reduction of an Ore* are available from Flinn Scientific, Inc.

Catalog No.	Description
C0100	Copper(II) Oxide, Powder, 100 g
C0201	Charcoal, Fine Powder, 100 g

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.