

Student experiment
(5th - 10th grade)

The reduction of copper oxide by hydrogen

🕒 Time: max. 20 min.

Safety:

safety glasses



The stopper can be loosened by either too much gas production or a needle which penetrates it with too much difficulty. This will allow gas to escape. Pressing the stopper too firmly into the test tube, however, may also break the test tube.

Needles should also be blunt, in order to reduce the danger of injury.

Do not breathe the gas produced in this reaction! Be careful when handling concentrated acids and burner flames.

Instruments:

- copper strips (0,1 mm thickness)
- a wooden clothespin
- low-cost ethanol burner
- low-cost gas developer
- 10 ml disposable pipette
- a dull needle

Chemicals:

- concentrated hydrochloric acid (H: 314-335; P: 260-301+330+331-303+361+353-305+351+338-405-501)
- copper sulfate solution (H: 302-319-315-410; P: 273-305+351+338-302+352)
- granulated zinc

Experiment:

- Heat the copper strip in the flame of the low-cost ethanol burner, so that the oxygen in the air can react with the copper to form copper oxide.
- Place two spatulas of granulated zinc and a few milliliters of dilute copper sulfate solution into the test tube of the low-cost gas developer.
- Decant any black copper which may appear on the surface.

Experiment:

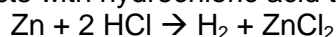
- Close the test tube using a perforated rubber stopper.
- Fill the 10ml disposable syringe with concentrated hydrochloric acid and attach it to the needle through the stopper. Put a rubber seal on the 20 ml disposable needle so that it fits tightly into the second hole in the stopper.
- Drip the concentrated hydrochloric acid slowly into the test tube.
- Collect the hydrogen gas generated using the 20 ml syringe. If the syringe is full, replace it with another syringe with a rubber seal (or use a syringe filled with active charcoal). Do not use the first syringe collected, because it contains a large amount of atmospheric air. Dispose of it.
- Place a blunt needle onto the syringe. Ignite the gas at the tip of the needle and carefully press the hydrogen gas as evenly as possible out through the needle.
- Hold the flame under the oxidized copper sheet for about 5-10 seconds, until a change occurs.

**Observations:**

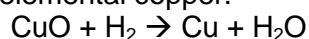
A gas emerges when concentrated hydrochloric acid is dripped onto the granulated zinc and caught in the 20 ml syringe. After holding the burning gas collected in the syringe under the oxidized copper sheet for about 10 seconds, a shiny, reddish dot remains behind on the sheeting.

Results:

Zinc reacts with hydrochloric acid to form hydrogen gas and zinc chloride.



Hydrogen has a reducing effect, so that the hydrogen flame reduces copper oxide to elemental copper.

**Disposal:**

Dispose of all zinc and copper waste in the container for heavy metals.