Demonstration (5th - 10th grade)	**Copper cent and iron nail**	**Time:** 10-15 min.

Safety:

Exhaust hood!

safety glasses

gloves

This experiment MUST be performed under an exhaust hood. Brown, foggy product results, which should not be breathed under any circumstances due to health and safety issues!

Instruments:

- 1 watch glass
- 1 pair of tweezers
- 1 small piece of fine sandpaper

Chemicals:

- concentrated nitric acid, HNO_3 (H: 272-314; P: 220-280-305+351+338-310)
- a copper cent (1 Euro cent coin)
- an iron nail

Experiment:

- Lightly sand an iron nail to expose fresh metal using sandpaper.
- Place a copper cent in a watch glass and put the glass under the exhaust hood. Turn on the exhaust fan!
- Drip a few drops of concentrated nitric acid (HNO_3) onto the coin.
- Remove the copper cent with the tweezers after a few minutes and rinse with water. Place the iron nail in the green liquid in the watch glass and let stand for a while.

Observations:

A brown gas evolves as soon as the acid contacts the copper coin. The solution turns green. After a short time, the iron nail will be coated with a copper-colored coating.

Results:

The nitric acid oxidizes the copper metal and forms Cu2+ ions. Nitrogen monoxide (NO) is evolved as a gaseous product.

$$3\ Cu\ (s) + 2\ NO_3^-\ (aq) + 8\ H^+\ (aq) \rightarrow 3\ Cu^{2+}\ (aq) + 2\ NO\ (g) + 4\ H_2O\ (l)$$

In the second part of the experiment, the iron nail is oxidized by the copper ions on solution and elemental copper coats the nail, while iron ions are given off into the solution.

$$Cu^{2+}\ (aq) + Fe\ (s) \rightarrow Fe^{2+}\ (aq) + Cu\ (s)$$