

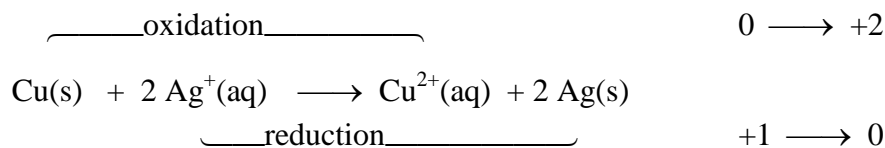
Rules for Assigning the Oxidation State or Oxidation Number (ON)

1. **For a monatomic ion the ON is equal to the charge.** [For Fe^{3+} ON = +3 ; for Cl^- ON = -1]
2. **For an atom in elemental form the ON = zero.** [For Na(s) ON = 0 ; for $\text{O}_2(\text{g})$ ON = 0]
3. Group I atoms have ON = +1 in compounds (except hydrogen has ON = -1 in hydrides, e.g. NaH),
Group II metals have ON = +2
[For K in KNO_3 ON = +1 ; for Ca in CaSO_4 ON = +2 ; for H in H_2O ON = +1]
4. Fluorine in compounds has ON = -1; chloride, bromide and iodide have ON = -1.
[For Cl in MgCl_2 ON = -1 ; for F in ClF_3 ON = -1]
5. **Oxygen is assigned ON = -2 whenever possible.** [For O in NaNO_3 ON = -2 ; for O in H_2O_2 ON = -1 because H has ON = +1; for O in O_3 ON = 0 because O_3 is elemental ; for O in H_3PO_4 ON = -2]
6. **Oxidations numbers for all atoms must add up to the charge in all molecules, ions, and radicals.**
In NaNO_3 Na has ON = +1 ; O has ON = -2 ; so N has ON = +5 because $(+1) + (+5) + (-2) \times 3 = 0$.
In $\text{Cr}_2\text{O}_7^{2-}$ O has ON = -2 ; so (each) Cr has ON = +6 because $(+6) \times 2 + (-2) \times 7 = -2$.
In KClO_4 K has ON = +1 ; O has ON = -2 so Cl has ON = +7 because $(+1) + (+7) + (-2) \times 4 = 0$.

Definitions:

Loss of **E**lectrons is **O**xidation **LEO** or **O**xidation is increase in oxidation number

Gain of **E**lectrons is **R**eduction **GER** or **R**eduction is decrease in oxidation number



Copper(II) is the oxidation product. Silver solid is the reduction product.

Copper solid is the **reducing agent**. Silver(I) is the **oxidizing agent**.

The reducing agent is the reactant in the oxidation half-reaction; it is itself oxidized—it gives up electrons.

The oxidizing agent is the reactant in the reduction half-reaction; it is itself reduced—it takes in electrons.