Halogen displacement reactions

A more **reactive** **halogen** can **displace** a less reactive halogen from **solutions** of its **salts**.

chlorine + potassium bromide → potassium chloride + bromine

$Cl_2(aq) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(aq)$

chlorine + potassium iodide → potassium chloride + iodine

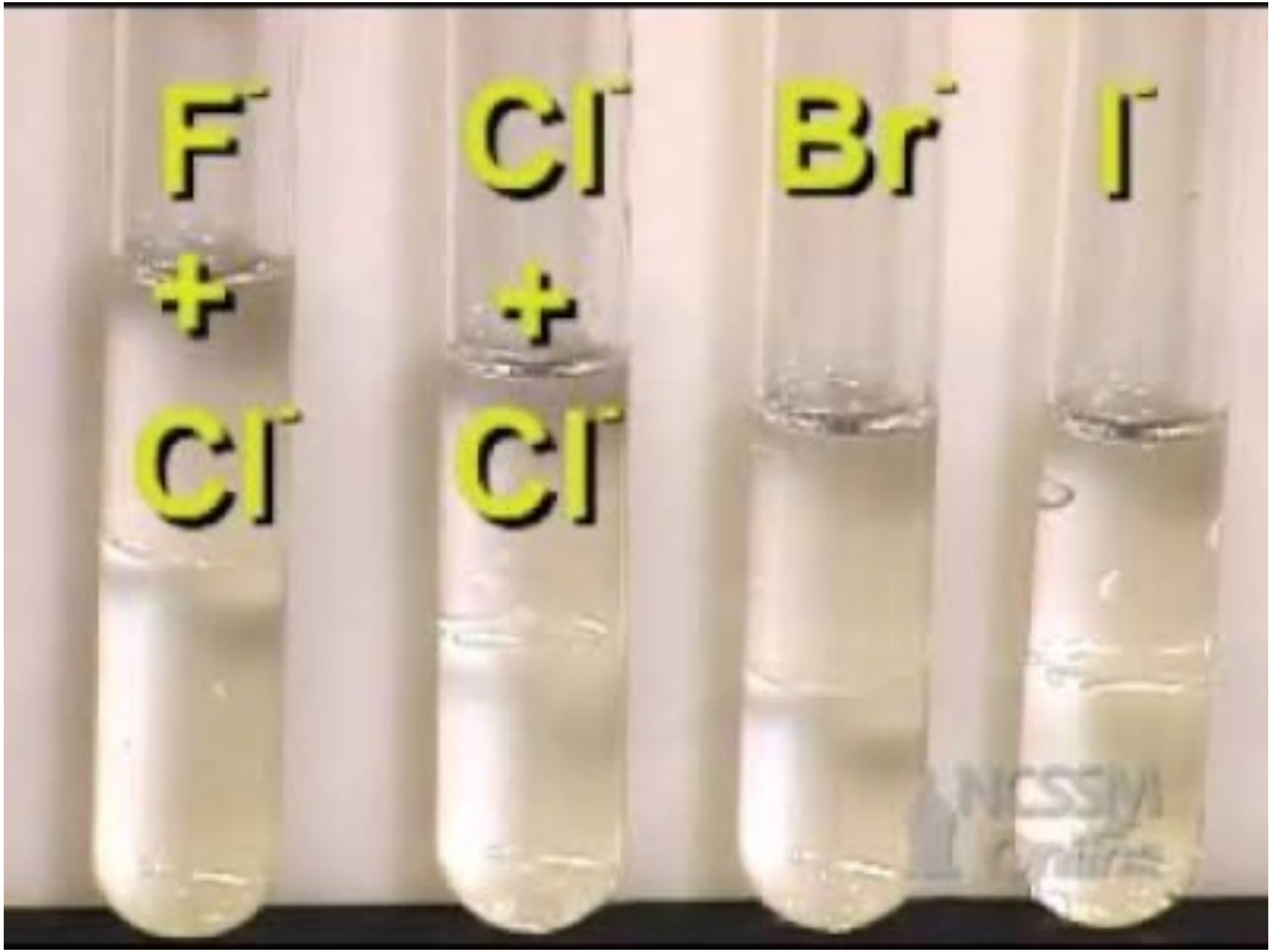
$Cl_2(aq) + 2KI(aq) \rightarrow 2KCl(aq) + I_2(aq)$

Potassium chloride , bromide and iodide solutions are colorless, but chlorine, bromine and iodine have colors.

Going down group 17:

- the atoms become larger
- the outer shell becomes further from the **nucleus**
- the force of attraction between the nucleus and the outer shell decreases
- an outer electron is gained less easily
- the halogen becomes less reactive

https://youtu.be/P2WaUvCLyCI



Redox reactions

$C + O_2 \rightarrow CO_2$

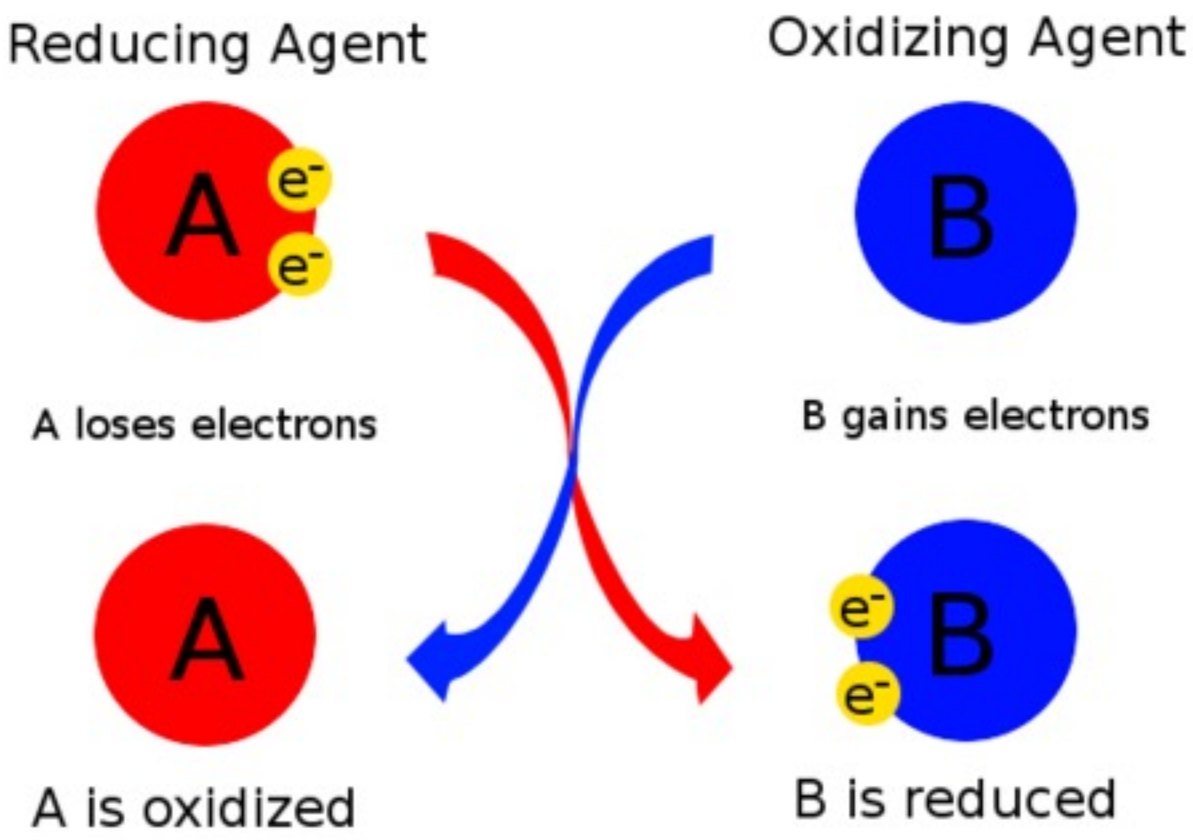
4 electrons move from C towards the two O atoms. We say C is oxidized. O gains electrons, oxygen is reduced (In CO_2: oxidation number of the carbon +4, O -2).

$H_2 + S \rightarrow H_2S$

What element is reduced and what element is oxidized?

Reactions involving the transfer of electrons from one atom to another are called oxidation – reduction reactions or REDOX.
In redox reactions some substances donate electrons, they are called reductant or reducing agents. Other substances gain electrons, they are called oxidizing agents or oxidants.

Examples of strong oxidants: oxygen, fluorine, chlorine.



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$Cl_2 + 2e^- \rightarrow 2Cl^-$

$Mn^{3+} + e^- \rightarrow Mn^{2+}$

$Cu^+ \rightarrow Cu^{2+} + e^-$

$I_2 + 6H_2O \rightarrow 2IO_3^- + 12H^+ + 10e^-$

Reduction or oxidation?

Redox reactions can be balanced using electron transfer

$Al + O_2 \rightarrow Al_2O_3$

$Al^0 + O_2^0 \rightarrow Al_2^{+3}O_3^{-2}$

$Al - 3e \rightarrow Al^{+3}$ 4

$O_2 + 4e \rightarrow 2O^{-2}$ 3

$Al \rightarrow Al^{+3} + 3e$

$O_2 + 4e \rightarrow 2\ O_3^{-2}$

$4Al + 3O_2 \rightarrow 2Al_2O_3$

Half equations

Redox reactions may be broken down into two half- equations. We can see the oxidation and reduction processes separately.

chlorine + potassium bromide → potassium chloride + bromine

$Cl_2(aq) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(aq)$

$Cl_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$

We can separate two processes:

$2Br^-(aq) \rightarrow 2e^- + Br_2(aq)$ oxidation

$Cl_2 + \cancel{2e}^- + 2Br^- \rightarrow 2Cl^- + \cancel{2e}^- + Br_2$

$Cl_2(aq) + 2e^- \rightarrow 2Cl^-(aq)$ reduction

If we don't put coefficient what will we see?

$Cl_2 \rightarrow Cl^-$

The number of atoms and the charges are not balanced. To balance the number of atoms and the charges we have to add two electrons and we have to add 2 as the coefficient before Cl^-: $Cl_2 + 2e^- \rightarrow 2Cl^-$