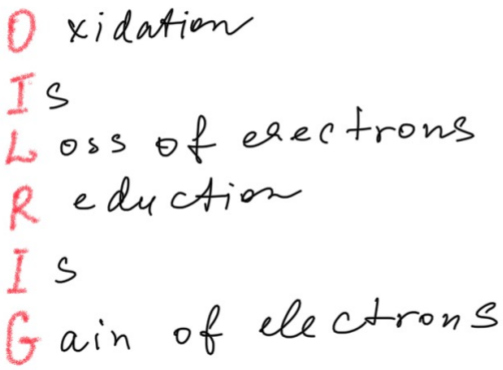
HW15. Redox reactions

A little something to help to remember what oxidation and reduction is.



How to identify if we have redox reduction? You should look if the elements changed their oxidation numbers:

$C^0 + O_2{}^0 \rightarrow C^{+4}O_2^{-2}$

4 electrons move from C towards the two O atoms. We say C is oxidized. The carbon had oxidation number 0, in the product (CO_2) carbon loses the electrons, oxidation number of the carbon +4). Oxygen is reduced, the oxidation number is going down from 0 in O_2 to -2 in CO_2.

Remember that the number of electrons lost has to be equal to the number of electrons gained in the reaction. We cannot create electrons from nothing.

Most commonly in the text books you will see that the number of lost electrons will be written down on the right side of the equation:

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

$$Al \rightarrow Al^{+3} + 3e \quad \textit{Al lost electrons – oxidation}$$

$$O_2 + 2e \rightarrow O_3{}^{-2} \quad \textit{O gained electrons - reduction}$$

Oxidation numbers help us to identify if the reaction is redox or not. Example of redox reaction:

$P_4 + F_2 \rightarrow 4PF_5$ If we write down oxidation numbers for the elements we will see that elements P and F changed their oxidation number, so this reaction is not only synthesis reaction, but redox reaction as well :

$P^0_4 + F^0_2 \rightarrow 4P^{+5} F^{-1}_5$

Here is example of a double replacement reaction:

$2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

With oxidation numbers it looks like this:

$2Na^{+1} Cl^{-1} + H^{+1}_2S^{+6}O^{-2}_4 \rightarrow Na^{+1}_2S^{+6}O^{-2}_4 + 2H^{+1} Cl^{-1}$

Oxidation numbers do not change, it is not the redox reaction.

Questions

1. Insert the equation coefficients, write oxidation numbers for all elements and determine if it is redox reaction or not:

$Mg+O_2 \rightarrow MgO$

$Fe+3Cl_2 \rightarrow FeCl_3$

$K_2SO_4 + HCl \rightarrow KCl + H_2SO_4$

$Cu + O_2 \rightarrow CuO$