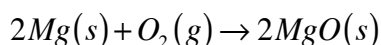


Oxidizing and Reducing Agents

An **oxidizing agent** causes the oxidation of another substance by accepting electrons from that substance. Thus, the oxidizing agent contains the atom that shows a decrease in oxidation number. In other words, the substance that is reduced is the oxidizing agent.

A **reducing agent** causes reduction by providing electrons to another substance. Thus, the reducing agent contains the atom that shows an increase in oxidation number. In other words, the substance that is oxidized is the reducing agent.

Consider the reaction between magnesium and oxygen to produce magnesium oxide.



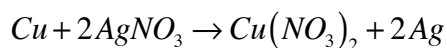
As we discussed earlier, magnesium is oxidized. It could be said that oxygen causes the oxidation of magnesium. Thus, oxygen is the oxidizing agent. Similarly, it could be said that magnesium causes the reduction of oxygen. Thus, magnesium is the reducing agent.

Some common oxidizing agents and reducing agents are shown in the table below.

Oxidizing Agent	Reaction Product	Reducing Agent	Reaction Product
O_2	O^{2-} , H_2O , or CO_2	H_2	H^+ or H_2O
F_2 , Cl_2 , Br_2 , I_2	F^- , Cl^- , Br^- , I^-	metals	metal ions
HNO_3	NO and NO_2	C	CO_2
$Cr_2O_7^{2-}$	Cr^{3+}	hydrocarbons	CO_2 and H_2O
MnO_4^-	Mn^{2+}		

Example 1

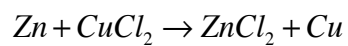
Use changes in oxidation numbers to identify which element is oxidized and which is reduced in the following reaction.



Also identify the oxidizing agent and the reducing agent.

Example 2

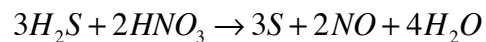
Use changes in oxidation numbers to identify which element is oxidized and which is reduced in the following reaction.



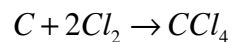
Also identify the oxidizing agent and the reducing agent.

Worksheet

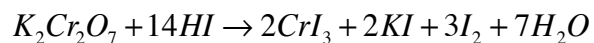
1. Identify the oxidizing agent and the reducing agent in the following reaction:



2. Identify the oxidizing agent and the reducing agent in the following reaction:



3. Identify the element that is oxidized and the element that is reduced in the following reaction:



4. Identify the element that is oxidized and the element that is reduced in the following reaction:

