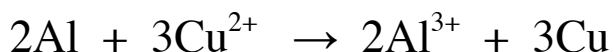
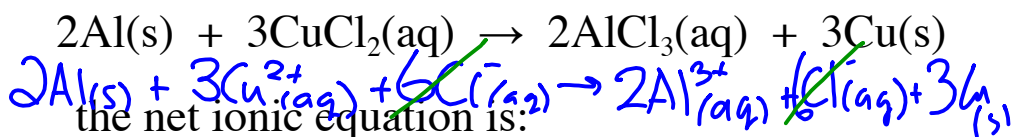


Introduction to Electrochemistry

electrochemistry = branch of chemistry concerned with the conversion of chemical energy to electrical energy (& vice versa)

- electrochemical reactions involve the **transfer of electrons** from one substance to another
- consider the reaction:



- electrons are transferred from Al to Cu^{2+}
- we can re-write this equation as two separate half-reactions

oxidation half-reaction: $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$

reduction half-reaction: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

loss of electrons = OXIDATION

gain of electrons = REDUCTION

LEO the lion says GER!



Lose Electrons Oxidation

Gain Electrons Reduction

Oxidation Is Losing e^- Reduction Is Gaining e^-

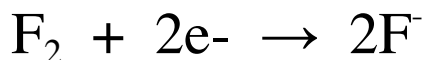
= OIL RIG



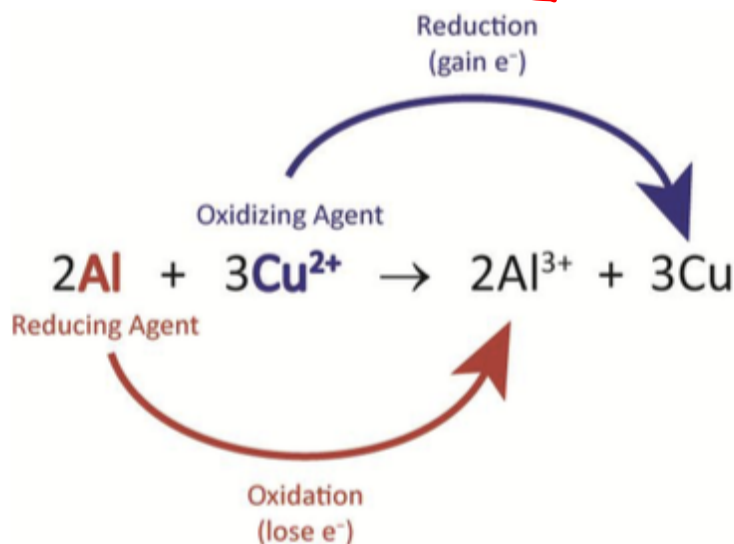
- when a substance becomes **oxidized** it becomes **more positively charged** because it is losing electrons (which are negatively charged)



- when a substance becomes **reduced** it becomes **more negatively charged** because it is gaining electrons



- every reduction reaction must be accompanied by an oxidation reaction since the electrons must be transferred somewhere
- > these are called **REDOX reactions**



- > Al is the **reducing agent** because it causes Cu^{2+} to become reduced
- > Cu^{2+} is the **oxidizing agent** because it causes Al to become oxidized

The **oxidizing agent** is the reactant reduced (gains e⁻) during a reaction.

The **reducing agent** is the reactant oxidized (loses e⁻) during a reaction.

Oxidation Numbers

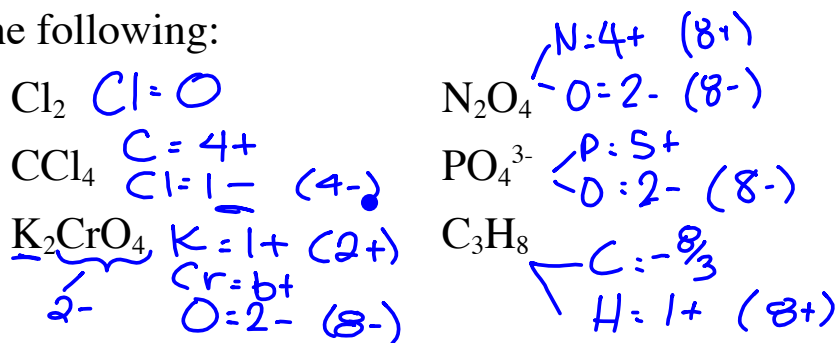
- oxidation numbers can be used to determine whether an atom has been oxidized or reduced

oxidation number = real or apparent charge an atom or ion has when all of the bonds are assumed to be ionic

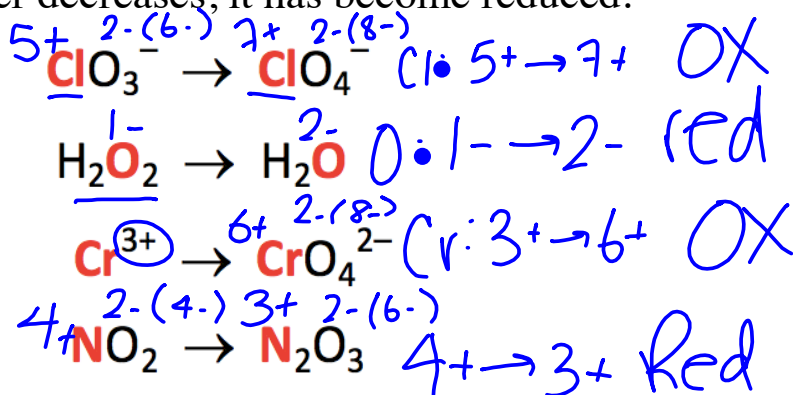
Determining oxidation number:

1. atoms in elemental form = **0**
2. simple ions = **the charge on ion**
 1. Li^+ , Na^+ , K^+ and all other **group 1 ions** have an oxidation number of **1+**
 2. Ca^{2+} , Ba^{2+} , Mg^{2+} and all other **group 2 ions** have an oxidation number of **2+**
 3. F^- , Cl^- , Br^- , I^- (**halogens**) are usually **1-** but there are many exceptions, especially in covalent compounds
3. **hydrogen** = **+1** (except in metallic hydrides such as NaH or BaH_2 where it is 1-)
4. **oxygen** = **2-** (in peroxides, H_2O_2 , it is 1-)
5. oxidation numbers of other atoms are assigned so that the **sum of the oxidation numbers** (positive & negative) **equals the net charge on the molecule or ion**

Determine the oxidation numbers of each atom for the following:



When an atom's oxidation number increases, it has become oxidized, and when an atom's oxidation number decreases, it has become reduced.



LEO

oxidation = loss of electrons = increase in oxidation number

reduction = gain of electrons = decrease in oxidation number

GER

