

# Why are we doing Redox Reactions?

- Some equations are very difficult to balance. By counting electron changes in oxidation and reduction we get a good start on balancing the equation.
- Determining oxidation numbers helps to review electron configurations and formula writing, the foundation of chemical communication.
- The process reminds us of the Law of Conservation of Matter, even with little things like electrons and charge.

# Oxidation Numbers

- **Definition:**

The oxidation number of an element is the charge on a single atom or ion of that element.

In standard practice, the charge of a formula is written with the number first -  $\text{SO}_4^{2-}$

The oxidation number is written with the charge first -  $\text{Mg}^{+2}$

Following these conventions helps us keep track of these ideas.

# Oxidation Numbers

- The first step to in using redox to balance equations is to determine the oxidation numbers of elements.
- The book has a nice list of “rules” for determining oxidation numbers - I can do the same process with only two rules:
  1. The sum of the oxidation numbers must equal the charge of the formula.
  2. Oxygen in compounds has an oxidation number of -2 unless it is in a peroxide where it is -1.

# Oxidation Number Practice

sodium chloride

NaCl

sodium is +1

chlorine is -1

# Oxidation Number Practice

iron (III) oxide



iron is +3

oxygen is -2

# Oxidation Number Practice

aluminum sulfate



aluminum is +3

oxygen is -2

sulfur is +6

# Oxidation Number Practice

hydrogen peroxide



hydrogen is +1

oxygen is -1

# Oxidation Number Practice

potassium

K

potassium is 0

potassium ion

K<sup>+</sup>

potassium is +1



# Redox

- **Reduction - Oxidation**
- Oxidation and reduction are complimentary processes - when something is oxidized something else must be reduced.
- Three common definitions:
  - Oxidation is the addition of oxygen, reduction is the loss of oxygen
  - Oxidation is the loss of hydrogen, reduction is the gain of hydrogen
  - **Oxidation is the loss of electrons, reduction is the gain of electrons.**

# Redox

- **LEO** the lion says **GER**
- **L**oss of **E**lectrons is **O**xidation
- **G**ain of **E**lectrons is **R**eduction

# Agents

- An agent causes something to occur.
- An oxidizing agent causes something else to be oxidized and is reduced.
- An oxidizing agent takes electrons from something else.
- A reducing agent causes something else to be reduced and is oxidized.
- A reducing agent supplies something else with electrons.

# Half Reactions

- A half reaction only tells half the story - either reduction or oxidation.

- Oxidation:



- Reduction



# Balancing Redox Reactions

There are many different styles or techniques for balancing redox reactions.

The common part to all of the techniques is to make sure that the number of electrons lost in oxidation is equal to the number of electrons gained in reduction.

The Law of Conservation of Matter - the electrons cannot be created or destroyed.

I don't care which technique you use, even if the book provides specific directions.

# Mr. D' s Redox Steps

1. Write correct formulas for all reactants and products.
2. Determine the oxidation number of all the elements.
3. Write half reactions for the elements whose oxidation numbers change.
4. Make the electrons gained equal to the electrons lost.
5. Place coefficients from the half reactions into the main reaction.
6. Balance the rest.

# Mr. D' s Redox Steps

7. For ionic equations, balance the charges with  $\text{H}^+$  for acid solutions and  $\text{OH}^-$  for base solutions.
8. Balance the hydrogen and oxygen by adding water as necessary.