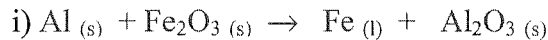


• Helton 1.1 - 1.2

1. Oxidation vs. Reduction

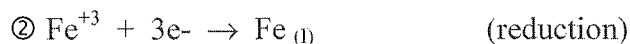
a) Two Reactions in One!



ii) There are two "half" reactions occurring!



iii) We must balance the half reactions charge using electrons:



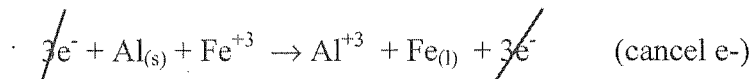
iv) **Oxidation = Loss of electrons**

"LEO the lion says GER"

Reduction = Gain of electrons

v) Oxidation and Reduction half reactions always occur together.

Called a **Redox reaction**.

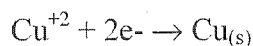


vi) **Oxidizing Agent** = substance doing the oxidation of other species
Fe⁺³ is the oxidizing agent
(Hint: it's the substance being reduced!)

Reducing Agent = substance doing the reduction of other species
Al_(s) is the reducing agent
(Hint: it's the substance being oxidized!)



i) What are the half reactions?



ii) What is being oxidized? $Mg_{(s)}$

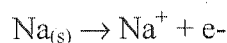
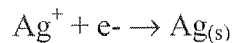
iii) What is being reduced? Cu^{+2}

iv) What is the oxidizing agent? Cu^{+2}

v) What is the reducing agent? $Mg_{(s)}$



i) What are the half reactions?

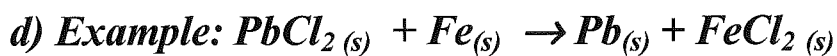


ii) What is being oxidized? $Na_{(s)}$

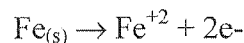
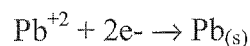
iii) What is being reduced? Ag^+

iv) What is the oxidizing agent? Ag^+

v) What is the reducing agent? $Na_{(s)}$



i) What are the half reactions?



ii) What is being oxidized? $Fe_{(s)}$

iii) What is being reduced? Pb^{+2}

iv) What is the oxidizing agent? Pb^{+2}

v) What is the reducing agent? $Fe_{(s)}$

Do Questions: #1-2 page 192 (Hebden); #1-4 page 621 (Heath)

3. Balancing Redox Reactions – Using Oxidation Numbers

a) What are “Oxidation Numbers”?

Sample: $K_2Cr_2O_7$ K is +1 Cr is +6 O is -2

- They are not actual charges!
- They are a bookkeeping system used to keep track of an atoms electrons!

i) Rules for Assigning Oxidation Numbers

1. Oxidation number of an atom as an isolated ion is the charge of the ion.

Eg: Cu^{2+} has oxidation number of +2

2. Oxidation number of an atom in elemental form is zero.

Eg. $Cu_{(s)}$ has oxidation number of 0

Eg. $O_{2(g)}$ has oxidation number of 0

Eg. $S_{8(s)}$ has oxidation number of 0

3. Oxidation of *common* atoms in a compound is its combining capacity

Common atoms include:

Group 1 (+1); Group 2 (+2); Halogens (-1); Oxygen (-2); Aluminum (+3)

Eg. Oxidation number of Al in Al_2O_3 is +3 (O is -2 in Al_2O_3 !)

Eg. Oxidation number of Na in NaF is +1 (F is -1 in NaF)

4. The sum of the positive and negative charges in a compound equals zero

Eg. $K_2Cr_2O_7$ K is +1, and O is -2 from rule 3.

To find oxidation number of Cr:

$$2(+1) + 2(x) + 7(-2) = 0$$

$$2 + 2x - 14 = 0$$

$$x = +6$$

5. The sum of the positive and negative charges in a polyatomic ion equals the charge of the ion.

Eg. MnO_4^- O is -2 from rule 3

To find oxidation number of Mn:

$$x + 4(-2) = -1$$

$$x - 8 = -1$$

$$x = +7$$

- ii) Example: What are the oxidation numbers for all the atoms in $\text{Al}(\text{NO}_3)_3$?

$\text{Al} = +3, \text{N} = +5, \text{O} = -2$

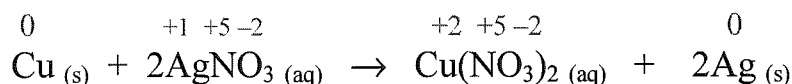
- iii) Example: What are the oxidation numbers for each atom in ClO_4^- ? (*Tricky!*)

$\text{Cl} = +7, \text{O} = -2$ (*oxygen "beats out" the halogen!*)

- iv) Example: What are the oxidation numbers for each atom in KH_2PO_4 ?

$\text{K} = +1, \text{H} = +1, \text{P} = +5, \text{O} = -2$

- v) Example: Use changes in oxidation number to identify which species is oxidized and which is reduced:

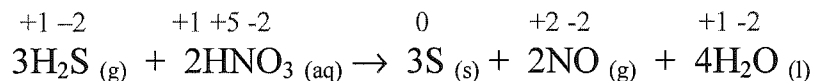


Assign oxidation numbers as above. Then look for change in ox. number!

Cu went from 0 to +2. This is a loss of electrons. Oxidation!

Ag+1 went from +1 to 0. This is a gain of electrons. Reduction!

- vi) Example: Identify the oxidizing agent and the reducing agent:



S went from -2 to 0. This is a loss of electrons. Oxidation!

Thus H_2S is oxidized or is the reducing agent!

N went from +5 to +2. This is gain of electrons. Reduction!

Thus, HNO_3 is reduced or is the oxidizing agent!

Do Questions: #3-6 page 194-195; #20-23 page 204