

Electrochemistry:

Definition:

The last unit was about the transfer of protons. This unit is about the transfer of electrons.

When the number of electrons in an atom changes:

Therefore, in order to recognise reduction-oxidation reactions (redox reactions):

Oxidation Number: "The charge an atom in a molecule would have if all the electrons in its bond belonged entirely to the more electronegative atoms" OR "A number assigned to an element to indicate its position on a scale of oxidation levels defined by an arbitrary set of rules"

Determining the oxidation number:

The Rules:

1)

2)

3)

4)

5)

Ex:

Ex:

Try one:

Read pg 193-194 and do #3

Oxidation Reaction:

* Used to be:

* Now is:

* Involves:

Reduction Reactions:

* Used to be:

* Now is:

* Involves:

* These two processes happen at the same time. In order for there to be a reduction, there must also be an oxidation and vice versa. One reactant loses an electron and the other gains it.

Ex:

Ex:

Ex:

Try one: (identify all the O.N.'s and say which is oxidized and which is reduced)

Remember that one is oxidized and when it oxidizes, it reduces the other? It is called the:

Remember that one is reduced and when it reduces it oxidizes the other? It is called the:

*For it to be a redox reaction, there must be a gain AND a loss

Assignment: Read pages 193-194 & 189-191 and do questions # 4, 5, & 1

Spontaneity of Red-ox Reactions:

When 2 reactants are mixed, the questions are:

- 1) will they react? and if so,
- 2) will the reaction not be spontaneous? or
- 3) will the reaction be spontaneous

Let's look at our last table

Standard Potential of Half Cells

Some points to consider:

- All reactions are written as reductions

- the ones that reduce strongly (a.k.a. strong oxidizing agents) are at the top left. THEY

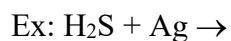
- the ones that oxidize strongly (a.k.a. strong reducing agents) are at the bottom right. THEY

Some tips:

- metals are usually at the bottom right
 - halogens and oxygen containing things are at the top left
 - CAREFUL: some things appear more than once and metals may have more than one charge.
 - Reactions can go both ways. Reactions that are near the top of the table will tend to go forward, near the bottom will tend to go backward.
- ***** be really careful many are on both sides

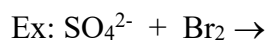
The Possibilities:

1/ Both reactants are on the same side:

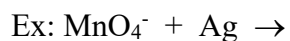


2/ Reactants are on opposite sides:

- a) the reactant to be reduced (on the left) is lower in the table than the one to be oxidized (on the right)



- b) The one to be reduced is higher than the one to be oxidized



Summary:

One more thing:

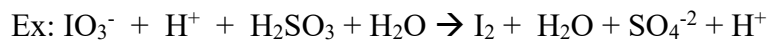
- some things require $\text{H}^+/\text{H}_2\text{O}$ (acidic conditions)
- some things require $\text{OH}^-/\text{H}_2\text{O}$ (basic conditions)

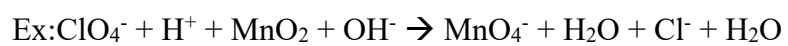
Read pages 195-199 and do questions #7, 8, 11, & 12

Balancing Half-Reactions:

Steps:

- 1/ Redox?
- 2/ Split into half reactions
- 3/ Balance the number of atoms
- 4/ balance the charge
- 5/ balance the number of electrons
- 6/ net reaction
- 7/ check





Try this one:

Another tip: We need to make sure that when we are doing the half reactions, we include all atoms involved with the atom that has changed.

Balancing in Acidic Conditions:

Steps:

1/ Redox?

2/ Split into half reactions

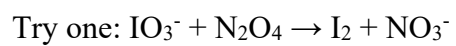
3/ Balance the number of atoms (add H₂O to side with less O)

4/ balance the charge

5/ balance the number of electrons

6/ net reaction

7/ check



Balancing in Basic Conditions:

Steps:

1/ Redox?

2/ Split into half reactions

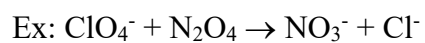
3/ Balance the number of atoms (add OH^- to side with less O)

4/ balance the charge

5/ balance the number of electrons

6/ net reaction

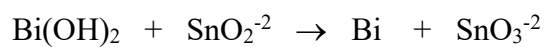
7/ check



First Way:

Second Way:

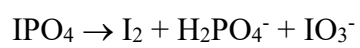
Try one:



- make sure you show each step for these ones.

A Nasty: (on Feb 08's provincial)

Balance in Basic Conditions:



(by the way, this is called a **disproportionation reaction** – when the reactant both reduces and oxidizes)

Assignment: Read pages 201-207 and do questions 24 a, f, k, n, u

Balancing Using The Whole O.N. Method:

Ex:



Read pages 208-209 and do questions #25 a, e, & m
Redox Titrations:

* the slow reaction of a reducing agent and an oxidizing agent.

* Equivalence is viewed (endpoint) via an indicator OR as a huge change in voltage. A redox indicator changes colour when it goes from its oxidized to its reduced form.

Ex: ferroin

Titration Curve would look much the same as for an acid base reaction.

Picking an oxidizing agent:

* You want to pick one that can oxidize many things:

Ex:

* another reason to pick MnO_4^- :

Picking a Reducing agent:

* I^- is used a lot because it can be oxidized by many things and we can use it (indirectly) as an indicator.

Two Steps to this titration:

1/ I^- is oxidized to I_2 by another reactant

2/ I_2 is reduced back to I^- with a second reactant to get a colour change.

It's called a back titration and you really don't have to know anything about it. Just read that section in the text.

	Read Pages 210-212
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