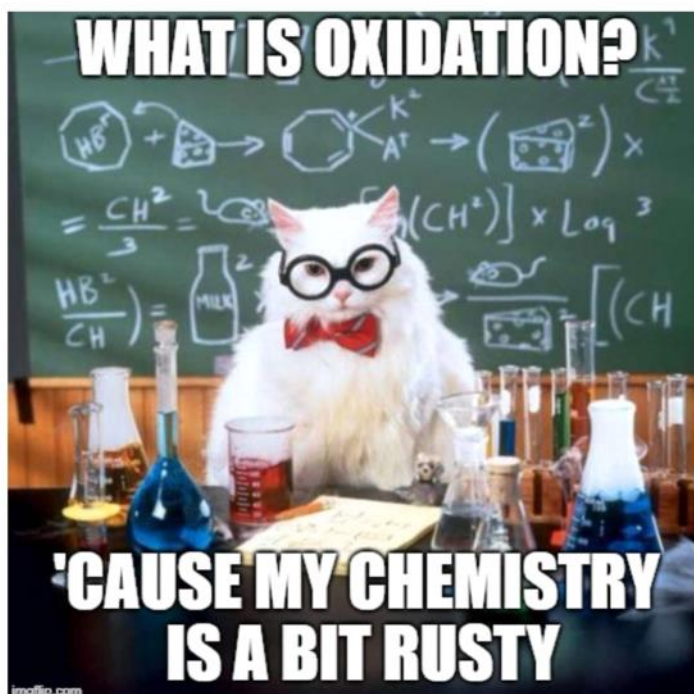


Chemistry 12

Unit VI



Oxidation - Reduction

Name: _____

Block: _____

I) Oxidation and Reduction

What is a redox reaction?

any rxn that involves the transfer of e^- from one substance \rightarrow another

What is oxidation?

• loss of e^-

What types of elements tend to oxidize? *metals*
(lose e^- to become \oplus charged)

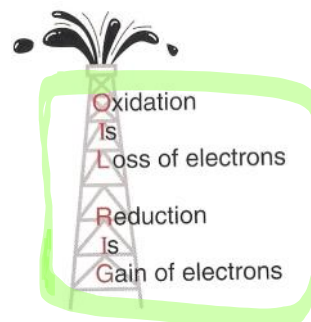
What is reduction?

• gain of e^-

What is a good way to remember oxidation and reduction?

LEO The Lion Goes GER

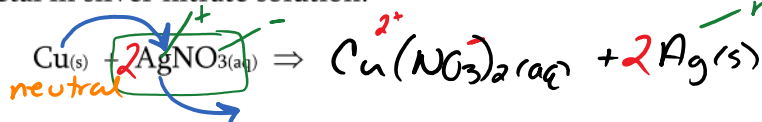
LOSE Electrons, Oxidize Gain Electrons, Reduce



e^- transfer

In order for a redox reaction to occur, there must be an oxidation AND a reduction (ie. one substance has to first 'give-up' electrons in order for another substance to gain them).
oxidize
reduce

Single replacement reactions are redox reactions. Take, for example, the reaction of copper metal in silver nitrate solution:



Copper starts as a metal (in atomic form - neutral) and becomes an ion dissolved in solution with a charge of $2+$. ~~What~~ ^{Does} copper donate or receive electrons?

donate How many? $2e^-$ (loss)

Therefore, Cu underwent oxidation and the half-reaction is:



Half Rxn:

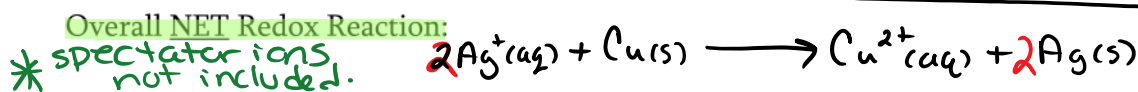
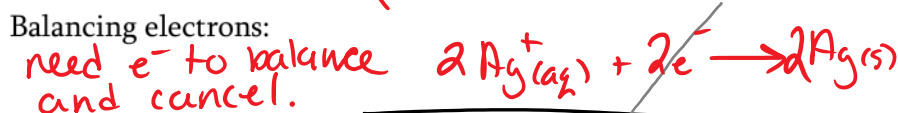
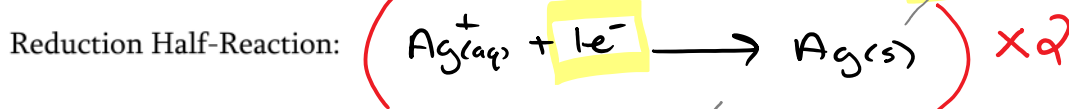
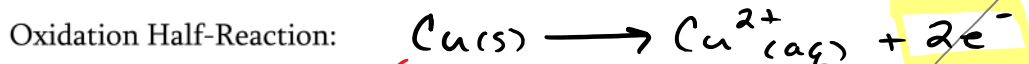
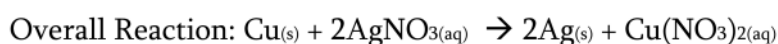
occur in $\frac{1}{2}$ of an Electrochemical cell (system that produces electrical energy!)

e^- shown as product when "lost"

Silver, as a reactant, is a dissolved ion with a charge of +1:
 What is silver as a product? Ag metal (neutral atom)
 Did silver donate or accept electrons? accepted / gained e⁻
 Therefore, Ag⁺ underwent reduction, and the half-reaction is:

$$\text{Ag}^+ + 1e^- \longrightarrow \text{Ag(s)}$$

Nitrate, NO₃⁻, started as a dissolved ion and didn't change, so it didn't take part in the redox reaction (it was a spectator ion).



For every copper atom that oxidized, two electrons were released, which are enough to reduce 2 Ag⁺ ions (the balanced e⁻ must reflect stoichiometry) (hence the 2:1 stoichiometry).

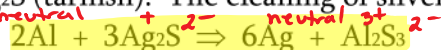
Notice that the reactant that was in metal form, copper, oxidized to become a cation, Cu²⁺, as metals tend to do. Ag⁺, a metal cation, reduced to become a metal (the opposite process - a reduction).

*Professor Dave: <https://www.youtube.com/watch?v=VXvtkwubQQg>

A half-reaction specifies the oxidation or reduction that occurred, whereas the net redox reaction is the combination of both and shows what and how the substances changed.

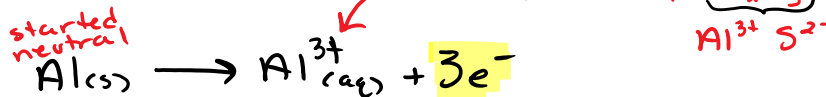
↳ e⁻ are not shown... should have balanced to cancel them.

Silverware (silver metal) reacts with H₂S that is present in trace amounts in air to produce Ag₂S (tarnish). The cleaning of silverware is a redox reaction:



*This reaction requires heat to attain E_a and water to act as an electron transfer medium. Thus, the silverware is placed into a pan of water which is lined with aluminum foil and then heated in the oven.

Oxidation half-reaction:



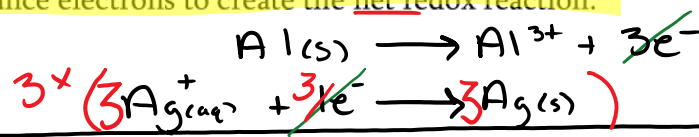
*Remember, oxidation is a loss of electrons, so electrons will be a product

Reduction half-reaction:



*Reduction is a gain of electrons, so electrons will be a reactant

Balance electrons to create the net redox reaction:



Notice that the electrons are not part of the net reaction, as they have been transferred from one substance to the other. *↳ implied by the charges.*

II) Oxidizing Agents and Reducing Agents

- An oxidizing agent is a substance that _____ another substance.
- Therefore, the oxidizing agent itself undergoes _____.
- What was the oxidizing agent in the previous example? _____
- A reducing agent is a substance that _____ another substance.
- Therefore, the reducing agent itself undergoes _____.
- What was the reducing agent in the previous example? _____