19-1 Oxidation & Reduction Reaction (Redox)

* We will use net ionic equations to determine what chemical interactions have taken place w/ electrons

- When electrons are transferred from one substance to another we call it a redox reaction (or reduction oxidation reaction).

ex) $2\,Br^-_{(aq)} + Cl_2{}^0_{(g)} \rightarrow Br_2{}^0_{(g)} + 2Cl^-_{(aq)}$

* Notice ions become molecules, and molecules become atoms when electrons are exchanged.

Chlorine molecule takes electrons from Bromine to become a negative ion & bromine loses electrons and becomes a molecule. - This is redox

Oxidation = loss of electrons to another substance

ex) $Na^0_{(s)} \rightarrow Na^+ + e^-$ (Na) is oxidized

Reduction = gaining of electrons from another substance

ex) $Cl_2{}^0_{(g)} + 2e's \rightarrow 2Cl^-$ (Cl_2) is reduced

Oxidation & Reduction are complimentary processes
- one makes the other happen & vice versa

Some pneumonic (acronym) devices to help you remember:

LEO says GER < Loss of electrons = oxidation
gaining of electrons = reduction

or OIL - RIG < oxidation is losing
reduction is gaining

Oxidizing & Reducing Agents

- In an oxidation reaction, the substance that accepts the electrons is known as the oxidizing agent (what is reduced)

- In a reduction reaction, the substance that loses the electrons (what is oxidized) is the reducing agent.

ex) $2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$
(oxidized: Na; reduced: Cl_2)

ex) $2HI_{(aq)} + Li_2S_{(aq)} \rightarrow H_2S_{(g)} + 2LiI_{(aq)}$

T.I.E. = $2H^+_{(aq)} + 2I^-_{(aq)} + 2Li^+_{(aq)} + S^{2-}_{(aq)} \rightarrow H_2S_{(g)} + 2Li^+_{(aq)} + 2I^-_{(aq)}$

NIE = $2H^+_{(aq)} + S^{2-}_{(aq)} \rightarrow H_2S_{(g)}$

What is Red. rxn? $2H^+ + 2e^- \rightarrow H_2$ $(+ \rightarrow \emptyset)$

What is Ox rxn? $S^{2-} \rightarrow S_{(g)} + 2e^-$ $(2- \rightarrow \emptyset)$

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to determine if oxidation or reduction has occurred — study the oxidation state of each atom involved.

ex) $Zn^{2+} \rightarrow Zn^{\circ}_{(s)}$

- elements that do NOT have an oxidation state are said to have an ox-state of zero or Zn°.

so, to go from $Zn^{2+} \rightarrow Zn^{\circ}$ is a gain of electrons or reduction & reverse $Zn^{\circ} \rightarrow Zn^{2+}$ is an oxidation

* If #'s go up = oxidation, down = reduction

ex) What kind of reaction is $H_{2(g)} \rightarrow 2H^+_{(aq)}$?

oxidation $(\emptyset \rightarrow +)$

What kind of reaction is $Na^+ \rightarrow Na_{(s)}$?

reduction $(+ \rightarrow \emptyset)$

What kind of reaction is $Fe^{2+} \rightarrow Fe^{3+}$?

oxidation $(2+ \rightarrow 3+)$