Oxidation – Reduction (aka Redox) Reactions

One or more electrons are transferred in a redox reaction

Examples: photosynthesis, oxidation of sugars, fats, and proteins, and combustion reactions

To keep track of the electrons transferred in a redox reaction, we assign oxidation states.

Oxidation State – arbitrary charge assigned to an atom

The Oxidation State of…	Summary	Examples
An atom in an element is zero	Element: 0	Na(s), O_2(g), Hg(l)
A monatomic ion is the same as its charge	Monatomic ion: charge of ion	Na^+, Cl^-
Fluorine is -1 in its compounds	Fluorine: -1	HF, PF_3
Oxygen is -2 in its compounds *Exception: oxygen is -1 in peroxides (O_2^{-2})	Oxygen: -2 *Except in peroxides: O is -1	H_2O, CO_2 *Exception: H_2O_2
Hydrogen is +1 in its covalent compounds	Hydrogen: +1	H_2O, HCl, NH_3
Hydrogen is -1 in binary metal hydrides	Hydrogen: -1	NaH, MgH_2

Neutral Compounds: sum of all oxidation states must equal zero

Examples: H_2O is neutral: each H is +1 and O is -2; SUM = 2(+1) + (-2) = 0

NaCl is neutral: Na is +1 and Cl is -1; SUM = (+1) + (-1) = 0

Ionic species: sum of all oxidation states must equal charge of the ion

Examples: NO_3^- has charge of -1; each O is -2 and SUM = -1

$N + 3(-2) = -1$

$N = +5$

$Cr_2O_7^{-2}$ has charge of -2; each O is -2 and SUM = -2

$2(Cr) + 7(-2) = -2$

$Cr = +6$

1. $\overset{+2\ \ -1}{CaBr_2}$

2. $\overset{0}{N_2}$

3. $\overset{+1\ +4\ -2}{Na_2CO_3}$ $(2)(+1) + C + (3)(-2) = 0$

$C = +4$

4. $\overset{+5\ -2}{ClO_3^-}$ $Cl + (3)(-2) = -1$

$Cl = +5$

5. $KMnO_4$ (+1 +7 -2)

$(1)(+1) + Mn + 4(-2) = 0$

$Mn = +7$

6. SF_6 (+6 -1)

7. Fe_3O_4 ($+\frac{8}{3}$ -2)

$3Fe + 4(-2) = 0$

$3Fe = 8$

$Fe = \frac{8}{3}$

8. CH_3F (-2 +1 -1)

$C + 3(+1) + (1)(-1) = 0$

$C = -2$

9. P_4 (0)

10. Al_2O_3 (+3 -2)

11. LiH (+1 -1)

12. SO_4^{-2} (+6 -2)

*LEO says GER

Oxidation – oxidation number increases, loss of electrons

Reduction – oxidation number decreases, gain of electrons

LEO = Loss of e- is Oxidation

GER = Gain of e- is Reduction

OIL = Oxidation Is Loss

RIG = Reduction Is Gain