

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 ₂ O, CO ₂ *Exception: H ₂ O ₂
Hydrogen is +1 in its covalent compounds	Hydrogen: +1	H ₂ O, 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: H₂O 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

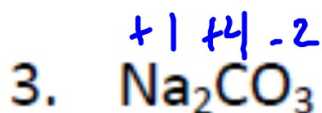
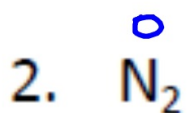
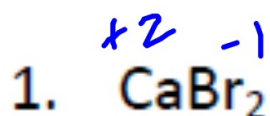
$$\text{N} + 3(-2) = -1$$

$$\text{N} = +5$$

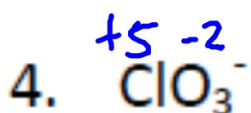
$\text{Cr}_2\text{O}_7^{2-}$ has charge of -2; each O is -2 and SUM = -2

$$2(\text{Cr}) + 7(-2) = -2$$

$$\text{Cr} = +6$$



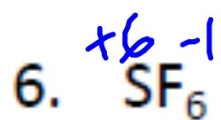
$$(2)(+1) + \text{C} + (3)(-2) = 0$$
$$\text{C} = +4$$



$$\text{Cl} + (3)(-2) = -1$$
$$\text{Cl} = +5$$

$$5. \quad \overset{+1}{K} \overset{+7}{Mn} \overset{-2}{O}_4 \quad (1)(+1) + Mn + 4(-2) = 0$$

$$Mn = +7$$



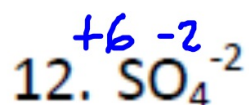
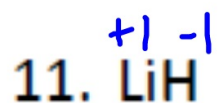
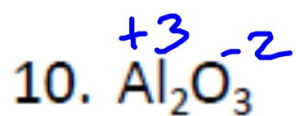
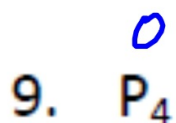
$$7. \quad \overset{+\frac{8}{3}}{Fe}_3 \overset{-2}{O}_4 \quad 3Fe + 4(-2) = 0$$

$$3Fe = 8$$

$$8. \quad \overset{-2}{C} \overset{+1}{H}_3 \overset{-1}{F} \quad Fe = \frac{8}{3}$$

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

$$C = -2$$



*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