

REDOX REACTIONS

RULES FOR ASSIGNING OXIDATION NUMBER

Rule 1

- In elements, each atom bears an oxidation number of zero.
- For example: H_2 ($\text{H} = 0$), O_2 ($\text{O} = 0$), S_8 ($\text{S} = 0$), P_4 , ($\text{P} = 0$) O_3 ($\text{O} = 0$) and C_{60} ($\text{C} = 0$)

Rule 2

- For ions composed of only one atom, the oxidation number is equal to the charge on the ion.
- For example: $\text{Na}^+ = +1$, Al^{3+} ON Al = +3, O^{2-} ON of O = -2

Rule 3

- Oxidation number of F is always -1 in its compounds (most electronegative element), In OF_2 F is always -1, O here is +2
- Oxidation number of O is -2 in its compounds except peroxides like H_2O_2 (-1) and superoxides (-1/2) like KO_2
- Oxidation number of H is +1 except in hydrides like Na^+H^- (-1)
- Oxidation number of Cl, Br, I is -1 except when bonded to F or O
- Oxidation number of Group 1 elements is +1 (Li, Na, K, Rb, Cs)
- and Group 2 elements is +2 (Be, Mg, Ca, Sr, Ba)

Rule 4

- Sum of oxidation numbers of all the atoms in a compound must be zero.
- CH_4 Here $\text{C} + 4\text{H} = 0$
- In polyatomic ion, the algebraic sum of all the oxidation numbers of atoms of the ion must equal the charge on the ion.
- PO_4^{3-} Here, $\text{P} + 4\text{O} = -3$

Examples (Find oxidation number of atom in red)

- PO_4^{3-} P=? $\text{P} + 4(\text{O}) = -3$, $\text{P} + 4(-2) = -3$, $\text{P} = -3 + 8 = +5$
- Na_2SO_3 S=? $2\text{Na} + \text{S} + 3(\text{O}) = 0$, $2(+1) + \text{S} + 3(-2) = 0$, $\text{S} = 0 + 6 - 2 = +4$
- $\text{K}_2\text{Cr}_2\text{O}_7$ Cr=? $2\text{K} + 2\text{Cr} + 7(\text{O}) = 0$, $2(+1) + 2\text{Cr} + 7(-2) = 0$, $2\text{Cr} = 14 - 2 = 12$, $\text{Cr} = +6$
- $\text{Na}_2\text{B}_4\text{O}_7$ B=? $2\text{Na} + 4\text{B} + 7\text{O} = 0$, $2(+1) + 4\text{B} + 7(-2) = 0$, $4\text{B} = 12$, $\text{B} = 12/4 = 3$
- NO_3^- N=? $\text{N} + 3(\text{O}) = -1$, $\text{N} + 3(-2) = -1$, $\text{N} = -1 + 6 = +5$
- NH_3 N=? $\text{N} + 3(\text{H}) = 0$, $\text{N} + 3(1) = 0$, $\text{N} = -3$