

Unit 7: Reduction, Oxidation and ElectrochemistryChapter 17: Electrochemistry4.9: Oxidation-Reduction Reactions

Reduction-Oxidation Reactions (Redox Rxn): - chemical reactions where there is a transfer of electron(s).

Oxidation States (Oxidation Number): - a number that is arbitrary assigned to an atom in an element, molecule, and polyatomic ions to account for the number of electrons in *redox* reaction.

Rules for Assigning Oxidation Numbers:

1. Natural Elements (include diatomic and polyatomics) have an Oxidation Number of 0.

Examples: $\text{Na}_{(s)}$, $\text{O}_{2(g)}$, $\text{O}_3(g)$, $\text{H}_{2(g)}$, $\text{F}_{2(g)}$, $\text{P}_{4(s)}$, and $\text{Hg}_{(l)}$ all have an oxidation number of 0.

2. Single Atomic Ions have an Oxidation Number Equals to its Charge.

Example: K^+ has an oxidation number of +1.

3. Oxygen in Binary Compound and Polyatomic Ions has an Oxidation Number of -2.

Examples: CO_2 , CO , SO_3 , SO_2 , CO_3^{2-} , SO_4^{2-} and H_2O all have an oxidation number of -2 for oxygen.

An exception occurs in peroxides (compound containing O_2^{2-}) where the oxygen has an oxidation number of -1.

4. Hydrogen in Binary Compounds and Polyatomic Ions has an Oxidation Number of +1.

Examples: H_2O , HCl , HBr , CH_4 , NH_4^+ and H_2S all has an oxidation number of +1 for hydrogen.

5. In Binary Compounds, the Atom that has the most attraction to electrons (HIGHER Electronegativity) is assigned the NEGATIVE Oxidation Number. This Negative Oxidation Number is the SAME as its Ionic Charge.

Examples: HF : F is more electronegative. Thus, F has an oxidation number of -1.

NH_3 : N is more electronegative. Thus, N has an oxidation number of -3.

H_2S : S is more electronegative. Thus, S has an oxidation number of -2.

6. The Sum of all Oxidation Numbers is 0 for all Electrically Neutral Compounds.

Examples: CO : Oxidation numbers: $\text{O} = -2$; **$\text{C} = +2$** $[(+2) + (-2) = 0]$

SO_2 : Oxidation numbers: $\text{O} = -2$; **$\text{S} = +4$** $[(+4) + 2(-2) = 0]$

7. The Sum of all Oxidation Numbers is Equal to the Overall Charge for all Polyatomic Ions.

Examples: CO_3^{2-} : Oxidation numbers: $\text{O} = -2$; **$\text{C} = +4$** $[(+4) + 3(-2) = -2]$

SO_4^{2-} : Oxidation numbers: $\text{O} = -2$; **$\text{S} = +6$** $[(+6) + 4(-2) = -2]$

Note: Same Atom from different chemical species might NOT have the Same Oxidation Number.

We write the charges of ionic species as n^+ or n^- . Oxidation numbers are written as $+n$ or $-n$.

Oxidation And Reduction Study Guide Answers

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