

Terminology and Units

- **Oxidation** – To lose electrons
- **Reduction** - To gain electrons
- **Oxidizing agent** - causes the other reactant to oxidize; it is itself reduced.
- **Reducing agent** - causes the other reactant to reduce; it is itself oxidized.
- **Oxidation state (or number)** - A “virtual charge” on an atom within a molecule; used to track changes in electrons.

Units of electron transfer

- 96,500 **Coulombs** (C) = 1 mole of electrons
 - ▷ 96,500 is **Faraday's Constant** (F)
- 1 **Ampere** (Amps, A) = 1 C/s

Oxidation State (“OS”) Rules

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|---|--|
| ▶ Uncombined element: 0 | e.g., O ₂ , Fe |
| ▶ Sum of OS in a neutral species is 0 and in an ion is equal to the charge. | e.g., H ₂ SO ₄ , CO ₃ ²⁻ , Na ⁺ |
| ▶ Group 1 metals, +1; Group 2 metals, +2 | e.g., NaCl, BaCl ₂ |
| ▶ Fluorine in compounds: -1 | e.g., BaF ₂ |
| ▶ Oxygen: -2 in most covalent compounds | e.g., Na ₂ O |
| ▶ Exception: peroxides, in which oxygen's OS is -1 | e.g., H ₂ O ₂ |
| ▶ Exception: Superoxides, in which oxygen's OS is -½ | e.g., KO ₂ |
| ▶ H in compounds: +1 in covalent compounds with nonmetals | e.g., H ₂ S |
| ▶ Binary metallic compounds, Group 15: -3; Group 16: -2; Group 17, -1 | e.g., Na ₃ P, H ₂ S, SrF ₂ |

Balancing Redox Equations

Acid & Basic solutions

Note that the balancing process is nearly identical for balancing redox reactions in acidic and basic solutions; basic solutions add two extra steps.

- 1 Write the equations for the oxidation and reduction half reactions, excluding electrons (which we'll balance later).
 - ▶ These should include the non-redox components, e.g., $\text{CrO}_4^- \rightarrow \text{Cr}^{3+}$
- 2 For each half reaction:
 - ▶ Balance all the elements except H and O.
 - ▶ Balance oxygen using H_2O
 - ▶ Balance hydrogen using H^+
 - ▶ **Basic solutions:** Neutralize the H^+ by adding OH^- to both sides of the reaction
 - ▶ **Basic solutions:** Combine H^+ and OH^- to make H_2O
 - ▶ Balance the charge using electrons
- 3 Balance the electrons in the half-reactions by multiplying the half-reactions by integers as necessary
- 4 Add the half-reactions, cancelling items that appear on both sides.