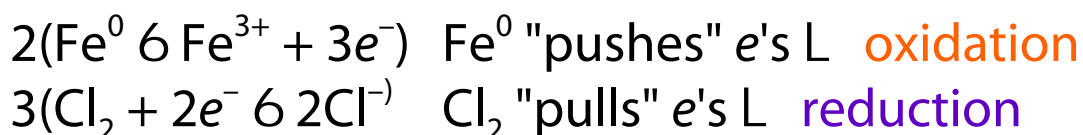


Oxidation-Reduction (Redox) Reactions

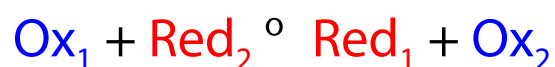
- L A reaction in which one species transfers electrons to another is an ***oxidation-reduction reaction***, also called a ***redox reaction***.



- T Oxidation is the ***loss*** of electrons by a substance.
- T Reduction is the ***gain*** of electrons by a substance.
- K ***There is never an oxidation without a reduction, and vice versa!***

Oxidizing Agents and Reducing Agents

- T An **oxidizing agent** (or **oxidant**) is a substance that causes another substance to be oxidized and is itself reduced.
- T A **reducing agent** (or **reductant**) is a substance that causes another substance to be reduced and is itself oxidized.
- L In these terms, all redox reactions take on the general form



Rules for Assigning Oxidation Numbers

- L ***Oxidation numbers*** are real or hypothetical charges on atoms, assigned by the following rules:
1. Atoms in elements are assigned 0.
 2. All simple monatomic ions have oxidation numbers equal to their charges. (e.g., all Group IA ions are +1; all group IIA ions are +2; all the following ions have oxidation numbers given by their charges - Fe^{2+} , Al^{3+} , S^{2-} , N^{3-})
 3. Fluorine is always -1 in its compounds.
 4. Halogens are usually -1, except when a central atom or when combined with a more electronegative element (e.g., assign I as -1 in NI_3 , but +3 in ICl_3).
 5. Oxygen is -2 in most of its compounds, except in cases like peroxides (H_2O_2 , Na_2O_2) where it is -1.
 6. Hydrogen is usually +1, except in hydrides with electropositive elements, particularly with metal cations, where it is -1 (e.g., NaH , CaH_2 , BH_4^-).
 7. The sum of all oxidation numbers for a neutral compound is zero; the sum is the charge on the species for a complex ion.

Oxidation-Reduction and Oxidation Numbers

- P When a species is oxidized, one of its atoms goes to a higher (more positive or less negative) oxidation number.
- P When a species is reduced, one of its atoms goes to a lower (less positive or more negative) oxidation number.

