ASSIGNING OXIDATION NUMBERS TO ELEMENTS

Review

The sum of all oxidation numbers in a compound or ion must equal the net charge on that compound or ion.

- The oxidation number (ON) of a free element is zero: O_2, S_8, F_2, Al
- The ON of a simple one-atom ion is the charge on the ion: Ca^{2+}, K^+, Cl^-
- The ONs of elements in a *neutral* molecule must add to equal zero: KCl, H_2O
- The ONs of elements in a *polyatomic ion* must be added to give the charge on the complex ion: NO_3^-, SO_4^{2-}

Some groups of elements are always assigned the same oxidation number.

- Alkali metals (Group I) have ON = +1 in their compounds: NaCl, KOH, NaH
- Alkaline earth metals (Group II) have ON = +2 in their compounds; Group III metals (B, Al) have ON = +3: CaS, BaO
- H *usually* has ON = +1, **except in metal hydrides with group I, II or III metals**; then, its oxidation number is -1. Examples: LiH, NaH, HCl, HNO_3, AlH_3, BH_3

The <u>most electronegative</u> element is assigned a negative oxidation number: ON = 8 – Group Number, where GN = 7 for group VII; GN = 6 for group VI, etc. HCN, CH_3COOH, $HClO_4$. Group Number (GN).

- The ON of fluorine **in its compounds** is always -1 because fluorine is the most electronegative element: HF, ClF, OF_2, CaF_2
- Because oxygen is the second most electronegative element, O *usually* has ON = -2 in its compounds. Exceptions are: OF_2, (ON = +2); peroxides [H_2O_2, Na_2O_2] (ON = -1); superoxides [KO_2], (ON = $-{}^1/_2$). H_2O, H_2SO_4, H_2O_2, Na_2O_2
- Other halogens (Group VII: Cl, Br, I) have ON = -1 in their compounds, *except* when they are combined with oxygen, or with another halogen that is **higher** on the periodic table. When it is not -1, their ON is positive, and must be determined by applying the rules above: OCl_2, ClO_4^-, ClF, HBr, NaCl

Revised: Spring 2004
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