Oxidation States

Chem1A, General Chemistry I

OXIDATION STATE GUIDELINES

The sum of the oxidation states in a neutral molecule must equal **ZERO**.

$H_2O \rightarrow$ H = +1 o.s., O = -2 o.s., so (2)(+1) + (1)(-2) = 0

The sum of the oxidation states in an ion must equal the **CHARGE** on that ion.

$SO_4^{2-} \rightarrow$ O = -2 o.s., S = +6 o.s., so (1)(+6) + (4)(-2) = +6 – 8 = -2

OXIDATION NUMBERS

1.) Pure elements (even polyatomics) are always **ZERO** unless a charge is explicitly written.

Fe, Br_2, S_8, C_{60} = 0 (but Mg^{2+} = +2 o.s.)

2.) Monatomic ions are always **EQUAL TO THEIR CHARGE**.

K^+ = +1 ; Se^{2-} = -2

3.) Any metal in a compound will always be **POSITIVE** and **EQUAL TO THE CHARGE** unless present as a pure element.

NaF → Na^+ = +1 o.s. ; iron(II) oxide → Fe^{2+} = +2 o.s. ; Fe(s) → Fe = 0 o.s.

4.) Fluorine is always **-1** unless present as a pure element.

CF_4 → F^- = -1 o.s. ; F_2 → F = 0 o.s.

5.) Oxygen is always **-2** unless bonded to F (**Rule 4**) or itself.
(**-1** when a peroxide, **0** as O_2).

H_2O → O = -2 o.s. ; OF_2 → O = +2 o.s. ; H_2O_2 → O = -1 o.s.

6.) Hydrogen is **+1** when bonded to a non-metal but **-1** when bonded to a metal and **0** when bonded to itself.

HBr → H = +1 o.s. ; NaH → H= -1 o.s. ; H_2 → H = 0 o.s.

7.) Halogens are always **-1** unless bonded to F, O, or themselves.

NaCl → Cl^- = -1 o.s. ; $ClF_4 \rightarrow$ Cl = +4 o.s. ; $OCl_2 \rightarrow$ Cl = +1 o.s.

8.) All other elements take on whatever oxidation state required to satisfy the guidelines.