RULES FOR ASSIGNING OXIDATION NUMBERS

1. ***The oxidation number (or oxidation state) of a monatomic ion is equal in magnitude and sign to its ionic charge.*** **For example, alkali-metal ions all have oxidation states of +1, alkali-earth-metal ions have oxidation states of +2, and the aluminum ion has an oxidation state of +3. Halide ions—F^-, Cl^-, Br^-, and I^-—all have oxidation states of –1. (Cl, Br, and I in polyatomic ions will have positive oxidation states.)**

2. ***The oxidation number of hydrogen is +1 when it is bonded to nonmetals. However, in metal hydrides, such as NaH or CaH_2, it is –1.***

3. ***The oxidation number of oxygen is –2, except in peroxides, such as H_2O_2 or Na_2O_2, where it is –1.***

4. ***The oxidation number of an atom in its elemental form is 0.*** **For example, each atom in H_2, Cl_2, O_2, N_2, P_4, S_8, Na, Al, Fe, etc., has an oxidation state of zero.**

5. ***For any neutral compound, the sum of the oxidation numbers of the atoms in the compound must equal zero.***

6. ***For any polyatomic ion, the sum of the oxidation numbers of the atoms in the compound must equal the net charge of the polyatomic ion.***

Steps for Half-reaction Method of Balancing Redox Equations

1) Write the ionic equation.
2) Assign oxidation numbers, and identify species undergoing oxidation and reduction.
3) Write incomplete* half-reactions: one for oxidation, the other for reduction.
(*Exclude spectator ions—those not participating.)
4) Balance for mass:
- **a. Balance elements other than H and O, first.**
- **b. Balance O by adding H_2O to the side where O is needed.**
- **c. Balance H by adding H^+ to opposite side.**

5) Balance for charge: Add *e⁻*s as needed to the side with the greater overall positive charge, so that both sides have the *same* charge—not necessarily zero. Check that oxidation half-reaction is losing electrons (on R) and reduction is gaining (on L).
6) Multiply each half-reaction by an integer so that the number of electrons lost in one equals the number gained in the other.
7) Add the two half-reactions and simplify—i.e., cancel species appearing on both sides. (Steps 4a, b, and c are for balancing reactions in acidic solution. For those in basic solution, begin by balancing as if in acidic solution, then add OH^-s at this point—*an equal number to both sides*—to "neutralize" the H^+s to produce water(s). Cancel waters if necessary.)
8) If applicable, add the appropriate number of spectator ions back in; *add the same number to both sides.*
9) Check equation for the same number of atoms and total charge on each side.