General College Chemistry 101 **Name:_____**

OXIDATION/REDUCTION (commonly abbreviated REDOX)

The set of reactions that involve the transfer of electrons between reactants are called oxidation-reduction reactions, or REDOX. When an atom, ion, or molecule has become more positively charged, we say that is has been oxidized. Loss of electrons by a substance is called **oxidation**. For example, when solid calcium loses two electrons, it is oxidized to Ca^{+2} in solution. This can be represented by the following half-reaction:

$$Ca \rightarrow Ca^{+2} + 2e^-$$

In contrast, when an atom, ion, or molecule has become more negatively charged, we say that it is reduced. Gain of electrons by a substance is called **reduction**. For example, when fluorine gains electrons, it is converted to the fluoride ion as shown in the following half-reaction:

$$F_2 + 2e^- \rightarrow 2F^-$$

Overall, when one reactant loses electrons, another reactant must gain them. As such, the oxidation of one substance is ALWAYS accompanied by the reduction of another as electrons are transferred between them.

Balancing Oxidation/Reduction Reactions – Half Reaction Method

1. Write the corresponding half reactions.
2. Balance all atoms except O and H.
3. Balance O; add H_2O as needed.
4. Balance H as acidic (H^+).
5. Add electrons to both half reactions and balance.
6. Add the half reactions; cross out "like" terms.
7. If basic or alkaline, add the equivalent number of hydroxides (OH^-) to counterbalance the H^+ (remember to add to both sides of the equation). Recall that $H^+ + OH^- \rightarrow H_2O$.

Balance each of the following oxidation/reduction reactions utilizing the half reaction method, place a block around your final answer:

1. $CH_3OH_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} \rightarrow CH_2O_{(l)} + Cr^{3+}{}_{(aq)}$ in acidic solution

2. $S_{8(s)} + NO_3^-{}_{(aq)} \rightarrow SO_3^{2-}{}_{(aq)} + NO_{(g)}$ in acidic solution

3. $Cr(s) + CrO_4^{2-}(aq) \longrightarrow Cr(OH)_3(s)$ in acidic solution

4. $NO_3^-(aq) + NH_3(aq) \longrightarrow NO_2^-(aq)$ in basic solution

5. $Cr_2O_7^{2-}{}_{(aq)} + Cl^-{}_{(aq)} \rightarrow Cr^{3+}{}_{(aq)} + Cl_{2\,(g)}$ in acidic solution

6. $Al(s) + MnO_4^-(aq) \rightarrow MnO_2(s) + Al(OH)_4^-(aq)$ in basic solution