Worksheet: Balancing Redox Reactions (Half-equation method)

The half-equation method separates the oxidation and reduction of a redox reaction in half reactions. Overall scheme for the half reaction method:

Step 1: Split reaction into half-reactions (reduction and oxidation)

Step 2: Balance the charge or oxidation number with electrons

Step 3: Balance O by adding H_2O

Step 4: Balance H by adding H^+

Step 5: Multiply by some integer to make electrons (lost) = electrons (gained)

Step 6: Add half equations and cancel substances on both sides

Step 7: (only in basic solution): add OH^- and cancel H_2O

Step 8: <u>Check</u> atom balance and charge balance on both sides of the equation!!!!

Complete and balance the following redox reactions (skeleton equations) using the half-equation method:

1. $Zn(s) + H^+(aq) ==> Zn^{2+} + H_2(g)$ (acidic solution)

_____ $2 e^- + Zn(s) ==> Zn^{2+}$ _____ (reduction)

___$2H^+(aq)$ _ ==> _ $H_2(g) + 2 e^-$ _____ (oxidation)

__$2H^+(aq) + Zn(s) ==> Zn^{2+} (aq) + H_2(g)$ _____ (overall)

2. $I^-(aq) + NO_2^-(aq) ==> I_2 (s) + NO (g)$ **(acidic solution)**

_2* $(e^- + 2H^+ (aq) + NO_2^-(aq) ==> NO (g) + H_2O (l))$ _____ (reduction)

___ $2I^-(aq) ==> I_2 (s) + 2 e^-$ _____ (oxidation)

___$2I^-(aq) + 4H^+ (aq) + 2NO_2^-(aq) ==> I_2 (s) + 2NO (g) + 2H_2O (l)$ _____ (overall)

3. $MnO_4^-(aq) + Cl^- (aq) ==> Mn^{2+}(aq) + Cl_2(g)$ (acidic solution)

_____$2*(5e^- + 8H^+(aq) + MnO_4^-(aq)$ _==> $Mn^{2+}(aq) + 4H_2O (l))$ _____ (reduction)

_____$5*(2Cl^- (aq) ==> Cl_2 (g) + 2 e^-)$ _____ (oxidation)

_____$16H^+(aq) + 2MnO_4^-(aq) + 10Cl^- (aq) ==> 2Mn^{2+}(aq) + 8H_2O (l) + 5 Cl_2 (g)$ _____ (overall)