Balancing Redox Reactions: Case 1 - Balance

$Cr^{+2}_{(aq)} + I_{2(aq)} \rightarrow Cr^{+3}_{(aq)} + I^-_{(aq)}$

oxidation: $Cr^{+2} \rightarrow Cr^{+3}$ reduction: $I_2 \rightarrow I^-$

Step 1. Divide the reaction into two half reactions: $Cr^{+2} \rightarrow Cr^{+3}$, $I_2 \rightarrow 2I^-$

Step 2. Balance each half reaction for mass

- In general, add H_2O to balance O, and H^+ to balance H

Step 3: Balance each half reaction for charge by adding electrons

$Cr^{+2} \rightarrow Cr^{+3} + 1e^-$, $2e^- + I_2 \rightarrow 2I^-$

Step 4: multiply half reactions by integers so that electrons cancel

- $2Cr^{+2} \rightarrow 2Cr^{+3} + 2e^-$, $2e^- + I_2 \rightarrow 2I^-$

Step 5: Add the half reactions and simplify: $2Cr^{+2} + I_2 \rightarrow 2Cr^{+3} + 2I^-$

Step 6: check to make sure that the rxn is balanced for mass and charge

Balancing Redox Reactions: Case 2: Balance

$C_2O_4^{2-}(aq) + MnO_4^-(aq) \rightarrow CO_2(aq) + Mn^{2+}(aq)$

1. Oxidation: $C_2O_4^{2-} \rightarrow CO_2$, Reduction: $MnO_4^- \rightarrow Mn^{2+}$
   - Assigning oxidation numbers shows that C is oxidized (+3 → +4) and Mn is reduced (+7 → +2)
2. $C_2O_4^{2-} \rightarrow 2CO_2$, $MnO_4^- \rightarrow Mn^{2+} + 4H_2O$

   $MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O$
3. $C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$, $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$
4. $5C_2O_4^{2-} + 10CO_2 + 10e^-$, $2MnO_4^- + 16H^+ + 10e^- \rightarrow 2Mn^{2+} + 8H_2O$
5. $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$
6. Check to make sure that the reaction is balanced for mass and charge

Balancing in a Basic Solution

- Follow above steps. At the end, add OH^- to each side to neutralize the H^+
- simplify H_2O terms if necessary