

2. Balancing Redox Reactions – Using Half Reactions

a) Half Reactions

Sample 1 $\text{Co}^{+2} \rightarrow \text{Co}$ “unbalanced” Oxidation or reduction?

$\text{Co}^{+2} + 2\text{e}^- \rightarrow \text{Co}$ “balanced” Reduction!!

Sample 2 $\text{NO} \rightarrow \text{N}_2\text{O}$ “unbalanced” Oxidation or reduction?

$2\text{NO} + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$ “balanced” Reduction!!

i) Half reactions must be balanced for charge and mass

ii) MAJOR OH⁻

- 1st balance major atoms,
- 2nd balance oxygen using water,
- 3rd balance hydrogen using H⁺
- 4th balance charge using e⁻

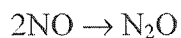
iii) Acidic vs. Basic solutions

Acidic – proceed as above

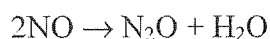
Basic – Bonus step: add OH⁻ equal to H⁺ on both sides; combine H⁺ and OH⁻ to form H₂O; cancel out water on both sides (between 3rd and 4th steps)

iv) Balance $\text{NO} \rightarrow \text{N}_2\text{O}$ (acidic)

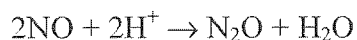
1st Balance for atoms other than O and H



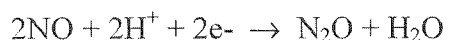
2nd Add water to balance O



3rd Add H⁺ to balance H



4th Add e⁻ to balance charge

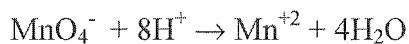


v) Balance $\text{MnO}_4^- \rightarrow \text{Mn}^{+2}$ (acidic)

1st Balance for atoms other than O and H



3rd Add H^+ to balance H



2nd Add water to balance O

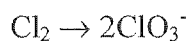


4th Add e^- to balance charge

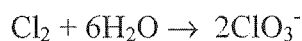


vi) Balance $\text{Cl}_2 \rightarrow \text{ClO}_3^-$ (basic)

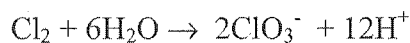
1st Balance for atoms other than O and H



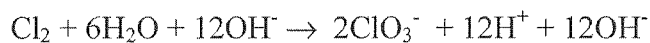
2nd Add water to balance O



3rd Add H^+ to balance H



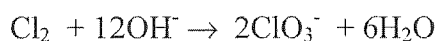
Bonus: Add OH^- , equal to H^+ on both sides



Combine H^+ and OH^-



Cancel out H_2O on both sides



4th step Add e^- to balance charge

