CONCEPT: BALANCING REDOX REACTIONS: ACIDIC SOLUTIONS

- **Balancing Redox Reactions** requires a new approach that accounts for the transfer of electrons between reactants.
  - For **Acidic Redox Reactions** we generally have the presence of the _____ ion.
  - Redox reactions not only balance the atoms of elements, but also _____ and _____.

Half-Reactions

- Balancing a redox reaction begins with identifying its *half reactions*.
  - **Half Reaction:** Either the oxidation or reduction reaction portion of a redox reaction.
  - Usually a half reaction is obtained by identifying the elements that are not _____ or _____.

EXAMPLE: Identify the half reactions from the following redox reaction.

$$\mathbf{Mn}O_4^- (aq) + H_2\mathbf{S}O_3 (aq) \longrightarrow \mathbf{Mn}^{2+} (aq) + H\mathbf{S}O_4^- (aq)$$

Balancing Acidic Redox Reactions

EXAMPLE: Balance the following redox reaction if it is found to be in an acidic solution.

$$NO_2^- (aq) + Cr_2O_7^{2-} (aq) \longrightarrow Cr^{3+} (aq) + NO_3^- (aq)$$

STEP 1: Break the full redox reaction into 2 half reactions.

- Focus on the elements that are not **oxygen** or **hydrogen** to determine the 2 half-reactions.

STEP 2: For each half reaction, balance elements that are not **oxygen** or **hydrogen**.

STEP 3: For each half reaction, balance the number **oxygens** by adding _____.

STEP 4: For each half reaction, balance the number **hydrogens** by adding _____.

STEP 5: Balance the overall charge by adding **electrons** to the more _____ charged side of each half reaction.

- If the number of electrons of both half reactions differ then multiply to get the lowest common multiple.

STEP 6: Combine the half reactions and cross out *reaction intermediates*.

- **Reaction Intermediates**: Compounds that look the same, with one as a reactant and the other a product.

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PRACTICE: Balance the following redox reaction in an acidic solution.

$$Cl_2\,(g) + S_2O_3^{2-}\,(aq) \longrightarrow Cl^-\,(aq) + SO_4^{2-}\,(aq)$$

PRACTICE: What is the coefficient of Fe^{3+} when the following reaction is balanced?

$$Bi^{3+}\,(aq) + Fe^{3+}\,(aq) + H_2O\,(l) \longrightarrow BiO_3^-\,(aq) + Fe^{2+}\,(aq) + H^+\,(aq)$$