7. BALANCING REDOX REACTIONS

UNIT 1 REACTIONS IN AQUEOUS SOLUTIONS
CH40S
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BALANCING REDOX EQUATIONS

- Redox reactions are often quite complicated and difficult to balance because you must account for all the electrons as well as the atoms!
- The method we will use to balance redox reactions is called the Half Reaction Method.

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THE HALF-REACTION METHOD:

1. Write the unbalanced net equation.
2. Split the equation into it's LEO and GER ½ reactions.
3. Balance all elements **except** "H" and "O".
4. Balance the "O's" by **adding water**, H_2O.
5. Balance the "H's" by **adding hydrogen ions**, H^+.
6. Balance the electric charge by **adding electrons**, e^-.
7. Multiply the two equations by appropriate coefficients to make the # of electrons in the equations equal.
8. Re-combine the two equations, canceling if needed.

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BALANCING NEUTRAL REDOX REACTIONS

Redox reactions that **don't** involve oxygen and hydrogen can be balanced fairly simply…

$Cu^+(aq) + Fe(s) \rightarrow Fe^{3+}(aq) + Cu(s)$

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BALANCING ACIDIC REDOX REACTIONS

Redox reactions that **do** involve oxygen and hydrogen are a different beast…

MnO_4^- + $C_2O_4^{2-}$ → MnO_2 + CO_3^{2-} (ACIDIC)

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WHAT IF IT'S BASIC?

Notice that the method has assumed the solution was **acidic** - we added H^+ to balance the equation. The $[H^+]$ in a basic solution is very small. The $[OH^-]$ is much greater.

For this reason, we will add enough OH^- ions to both sides of the equation to neutralize the H^+ in the overall reaction.

The hydrogen and hydroxide ions will combine to make water, and you may have to do some canceling before you're done.

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BALANCING A BASIC REACTION

Balance the reaction as if acidic, then tweak it like this…

$2MnO_4^- + 3C_2O_4^{2-} + \mathbf{2H_2O} \rightarrow 2MnO_2 + 6CO_3^{2-} + \mathbf{4H^+}$

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ALWAYS CHECK YOUR ANSWER!

Count charges on both sides. If they are equal, you are golden!

$2MnO_4^- + 3C_2O_4^{2-} + 4OH^- \rightarrow 2MnO_2 + 6CO_3^{2-} + 2\,H_2O$

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