Electrolytic Cells

# Electrolysis of Aqueous Solutions

## Steps

1. Separate all of the “ingredients” within the solution into their respective ions
2. Create 2 headings: “Cathode / Reduction / -‘ve” and “Anode / Oxidation / +’ve”
3. Group all of the positive ions under “Cathode…” and all of the negative ions under “Anode…”
4. If there are oxy-ion(s) (i.e. $NO\_{3}^{-}, ClO\_{4}^{-}, etc.$) present, calculate the oxidation charge for the non-oxygen element. If it possesses its highest oxidative charge, it cannot be further oxidized, and thus it becomes “useless” for the rest of the equation.
* **It is imperative to identify this reality, as it can mislead you for the remaining portion of the question**
1. Identify reduction charges for each of the ions
2. “Cathode…” 🡪 Pick the ion with the highest reduction potential (i.e. -0.14 over -0.52, etc.)
3. “Anode…” 🡪 Pick the ion with the lowest reduction potential (i.e. +1.07 over +1.23 etc.)
4. Solve

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| --- | --- |
| $NO\_{3}^{-}$ 🡪 | x – 6 = -1x= +5Since, Nitrogen’s max oxidation number is +5, it cannot be further oxidized. |

# Example

In a solution with SnBr2 and Al(NO3)3

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| Cathode/Reduction/-‘ve | $$E^{o}$$ | Anode/Oxidation/+’ve | $$E^{o}$$ |
| Sn2+ 🡪Al3+ 🡪H+ 🡪 | -0.14-1.66-0.83 | Br- 🡪$NO\_{3}^{-}$ 🡪O2- 🡪 | +1.07X+1.23 |



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| --- | --- |
| Cathode 🡪 | Sn2+ because it has the highest reduction potential |
| Anode 🡪 | Br - because it has the highest oxidation potential (lowest reduction potential) |

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| 2 Equations to be used:$$Sn^{2+} + 2 e^{-} \rightarrow Sn E^{o}= -0.14$$$$Br\_{2} + 2 e^{-} \rightarrow 2 Br^{-} E^{o}= +1.07$$$$Sn^{2+} + 2 e^{-} \rightarrow Sn E^{o}= -0.14$$$$2 Br^{-} \rightarrow Br\_{2}+ 2 e^{-} E^{o}= -1.07$$$$Sn^{2+}+ 2 Br^{-}\rightarrow Sn + Br\_{2} E^{o}=-0.61 $$ |